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PUBLIC WORKS

City, County and State Engineering and Construction

MARCH, 1936

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TIMEWASTERS:

ANENT some of our foolish problems of the past few months, Mr. J. A. McNamara writes: "With 9 people in two rooms, the sine of I angle would be equal to 26 lbs. of butter 25 feet long on the Y part of the track. Then, if we place a board measure across the hole full of dirt, we have for answer a tolerable high brush pile." Thank you, Mr. Mac, I enjoyed your note very much. Let's hear from you some more. But now for some serious problems.

3, 3, 3, 3:

Other publications have fallen to the lure of Timewasters, and one of them recently had a 4, 4, 4, 4 problem, in which all four 4's were combined to form all numbers up to 21. We submit, as a better one, the job of using all four 3's, combined by adding, subtracting, multiplying, dividing, using decimal points and parentheses, to get up to 25. Ye editor lacks only 22 and 25. It goes this way: $3+3\div3+3=1$; $(3\div3)+(3\div3)=2$, etc. Go to it.

The Oklahoma Flagpole:

At a point directly south of a flagpole, the vertical angle from the ground to the top of the pole is 45°; at another point 200 feet directly east of the first point, the angle from the ground to the top of the pole is 35°. How tall is the pole? *By Wm. B. Kalhoefer*, who had better send the solution, too.

Look on page 56:

Lack of space requires that our month's third problem, contributed by Ray Giddings of the Calcium Chloride Association, be placed on another page.

Reams of Paper—

Were used by a number of professional and amateur waterworks engineers in connecting up those houses and dead ends mentioned last month, but we are still in ignorance as to how to do it. Try again, gentlemen.

The Leaping Frog:

Yep, he made it in 28 jumps; 27 jumps got him up 27 feet, but the last 3-foot leap got him out.

Apologies; and Solutions:

The fly-on-the-wall problem last month was really sent in by Edgar Smith from California, but E. R. Dike of Tennessee sent in one almost exactly similar. The answer is 29.5 feet, obtained by laying the walls out on the floor. Frank Rantsma collaborated with Mr. Smith on this one. As to the alcohol problem by John Bevan, there is just as much water in the one jar as there is alcohol in the other. W. A. H.

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A. PRESCOTT FOLWELL, Editor — **W. A. HARDENBERGH**, Asso. Editor

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PUBLIC WORKS

City, County and State Engineering and Construction

Vol. 67 — *March, 1936* — No. 3

Heavy Construction on Wyoming Highway Work—The Taggart Construction Co.

Oiled Road Construction in Wyoming

By James B. True

Superintendent-Engineer, State Highway Department

IN CARRYING out the general plan of improving to a higher standard the surface of the main interstate trunk highways, continuing the construction of some mileage of intrastate highways and improving some mileage of secondary roads, it has been necessary to study the amount and character of the traffic along with the soil and moisture conditions of the territory through which the various roads are to be built in order to have enough funds to cover the mileage necessary to be oiled to conserve the investment in gravel and provide a usable surface. These studies, together with the experience gained by the engineers of the Department, as well as those of other Western States led to the adoption for 1935 construction of five more or less distinct types of construction, the costs per mile of which are shown in the table.

Group No. 1 includes 92 miles. This mileage is through territory where there is small rain-fall and the soil is predominantly sandy. Traffic is light, the entire mileage being on secondary or intrastate roads. The essentials of construction technique consist of blading enough material from the surface to give a windrow of two square feet, applying a penetration coat of MC-1 (kerosene cutback asphalt) of 0.3 gallons per square yard, blading the windrow over the surface, application of 2/3 gallon of MC-2, mixing by blades or road mix machines, spreading, rolling and seal coating with RC-1 (Naphtha cutback asphalt).

As shown in the table the cost runs $1,653.00 per mile but on considerable of the mileage the cost was $1,440 per mile, the higher average being caused by using a 3-square foot windrow instead of a 2-square foot windrow on some of the work. A 1½″ to 2″ mat 20 to 23 feet wide is obtained by this method. There is left 2″ to 3″ of gravel base course between the mat and the subgrade which is composed of soil satisfactory for support of the load. In exceptional cases where unsatisfactory

Construction Cost per Mile of Oiled Roads

Group	*1*	*2*	*3*	*4*	*5*
Prime Coat MC-1	$ 394	$ 302	....	....	....
Aggregate	....	587	$1,138	$1,265	$2,144
SC-3	....	....	1,439	....	....
MC-2	757	1,067	....	1,774	....
RC-2	....	....	....	....	1,711
Seal Coat RC-1	168	157	205	173	....
Processing	334	432	701	624	851
TOTAL	$1,653	$2,545	$3,483	$3,836	$4,706
Miles Represented	92	36	184	47	24

soil is encountered it is either removed and replaced by, or stabilized with, additional gravel. Course sub-base material is added where moisture conditions are detrimental. The cost of the sub-grade reinforcement is not included in the costs given in the table.

Group No. 2 consists of projects where soil, moisture and traffic conditions indicate that a greater total thickness of top and base is required. The operations are the same as described for Group 1 except that 1000 tons per mile of new gravel is added and the windrow is in general 3 square feet instead of 2 square feet, giving a correspondingly thicker mat with a $900 per mile increase in cost.

Road Mix Types

The projects listed in Group No. 3 are the standard road mix type differing from the above in that enough gravel is added to form a 6-square foot windrow and no prime coat is used. SC-3 (slow curing road oil) is used and the result is a dense graded mat 2½" thick.

Group No. 4 has the same general characteristics of Group 3 except that medium curing cutback asphalt is used in place of the slow curing road oil. The use of the cutback instead of the road oil is in line with the trend toward the greater use of the cutback asphalt. Experience has shown that a stronger and more stable mat is obtained and while the asphalt itself costs more and slightly more quantity is needed for the same type of aggregate the increased cost of $300 per mile is justified.

All of the above are gravel of the dense graded aggregate type of road mix, the processing being done either by blades, Clyde Woods road-mix machines or Barber-Greene machines.

Group No. 5 includes 24 miles of surface constructed with crusher run limestone which would come between the dense graded and the open graded type. On this account the rapid curing type of asphaltic binder was used. The material was mixed in a Barber-Greene machine. After laying down, some choking with crusher fines or sand was required in connection with the seal coat to make the mat impervious. Excellent sub-grade and drainage conditions are found on this work, but no gravel was available, hence the use of the rock which required the use of the RC type of cutback. So the $900 increased cost over the Group 4 type is chargeable to the absence of local gravel rather then the necessity of a higher type of mat.

Importance of Sub-grades

The greatest improvement in the State's oiling work during the year has not been so much in changes in the mat itself but to increased care being taken to determine the supporting power of the sub-grade, strengthening the weak places, taking advantage of the excellent soil and lack of detrimental moisture conditions which obtain in a large part of the State; and, lastly, extreme care in seeing that the sub-grade under the edges is constructed of proper material and thoroughly compacted before the oil mat is laid.

On January 1, 1931 there were 351 miles of roads on the State system with an oiled or higher type surface. On January 1, 1936, there were 2,510 miles with oiled or higher surface out of the 3,573 miles on the system. All of the so-called interstate or trunk roads have an oiled surface, all State highways in four counties of the State are oiled and there are some of the State highways oiled in all of the Counties of the State.

Maintenance Costs

Maintenance costs of oiled roads vary but average $230 per mile, which costs include all work on the right of way including snow removal, as well as seal coating and surface maintenance. The cost of maintenance does not vary with the traffic volume on highways carrying less than 1,000 vehicles per day, and few of Wyoming's highways have a greater traffic volume than 1,000 vehicles per day, nor does it vary with the thickness of the oiled mat. It does vary some with the character of the traffic but the principal factor causing difference in maintenance costs is neglect on construction, of the points mentioned above. One county which had in 1934, 109 miles of oiled roads showed a cost of $88 per mile, one ten-mile section costing $47 per mile.

With the completion of the work outlined, the status of the State Highway system as to surface types is as shown in the table.

Mileage of State Highways

Surface Type	*January 1 1931*	*January 1 1933*	*January 1 1936*
Earth	1,342	708	390
Gravel	1,431	1,294	673
Oil or Higher	351	1,387	2,510
TOTAL	3,124	3,389	3,573

The work to be put under way during 1936 depends on funds which become available. It is proposed to continue on the same general plan as was followed in 1935. The projects graded and drained will have to be oiled to make them render full service. At the same time, the State Highway system will have to be extended and secondary roads built.

Stabilization of Soils by Bitumen Emulsion

This publication is a reprint of Technical Paper No. 11, originally issued by the Engineer-in-Chief, Army Headquarters (India). Tests carried out on the R.A.F. aerodrome at Karachi are described. The soil is a sandy silt which breaks up readily under the action of a tail-skid. During rain, the ground becomes waterlogged and subject to scour. An area of 48,000 sq. ft. of the aerodrome was treated, as an experiment, in the manner to be described. Ten days after the work was completed the following tests were carried out:—(1) A 20-ft. square on the treated surface was enclosed round the edges and flooded with water to a depth of 2 in. On the third day the water had evaporated, but very little had been absorbed by the soil. (2) Tests with aeroplanes showed that the tail-skid made little or no impression on the surface. (3) A loaded, iron-tyred bullock cart was passed backwards and forwards about 30 times in the same track, without making an impression where the work had been correctly finished. The surface has the appearance of a rough grindstone and has stood heat and drought for over three months without any sign of breaking or dusting up. There has also been 24 hrs. of continuous rain and a heavy cloudburst, which left the stabilised strip sound and intact.

A detailed description of the operation of preparing the stabilised surface is given. As a preliminary it is necessary to ascertain the correct mixture of soil, water and bitumen by laboratory tests of the actual soil. For the Karachi aerodrome the following specification was arrived at:—Mix 33 1/3 cu. ft. of compacted field soil (approximately 40 cu. ft. of loose soil) with 75 gals. of water and 9.1 gals. of bitumen emulsion; pug thoroughly until the best mixture has been obtained and most of the excess moisture has evaporated; level surface and roll as soon as it will take the weight of a roller. Depth stabilised, 4 in. The practical application of this specification is gone into and approximate costs given.

C. H. HASWELL: *Central Board of Irrigation (India), Publication* No. 9. Simla, 1935 (The Board), 13 in. by 8¼ in., pp. vii + 14, pl. 7, chart in pocket, unpriced. Reported in Road Abstracts.

An Elevated Tank With Some Unusual Features

The new elevated tank at Spartanburg, described in this article. Inset shows supports and general appearance

SPARTANBURG, S. C., last year built a 1.5-million-gallon tank 117 ft. high to high-water mark, which possessed some unusual features. One of these was that the capacity was 50 percent greater than that recommended by the Underwriters. A one-million-gallon tank would have cost (bid price) $46,844; but for $11,040 extra they could obtain one 50 percent larger, which seemed a good investment.

The present summer demand is 4.5 mgd, with a peak slightly in excess of the capacity of the 27″ c.i. pipe line connecting the city with a 3,000,000-gallon reservoir 9 miles away. Prior to the building of this tank the only reserve supply nearer than this reservoir was a 225,000-gallon tank, and the Underwriters recommended a larger storage near the center of distribution to offset the need of a dual pipe line from the storage reservoir and to maintain a more constant pressure in the high-value district.

In addition to the tank proper, the improvement expenditures included $7,500 for land site, $8,600 for foundation, $6,000 for pipe connections to the distribution system, $1,100 for an 8-ft. fence, $2,000 for altitude valve and long distance recorder and $3,000 for engineering and inspection; a total of $86,084.

J. K. Marquis, left, engineer in charge of filtration and pumping, and project engineer

The new tank is connected with the distribution system by one 14″, one 12″ and one 10″ line, all equipped with check valves so that a higher fire pressure can be used if desired, with a bypass around each check valve. The 8″ bypass around the 14″ check is equipped with a Fisher altitude valve for controlling the water level in the tank. The altitude valve is equipped with a solenoid switch controlled from the fire department main station, by which this bypass can be closed when a higher pressure is desired. The pressure at city limits is 105 lbs., but this is reduced to 95 lbs. by means of an 8″ reducing pressure valve.

The tank is elliptical in vertical section, with a horizontal diameter of 87 ft., but the entire contents is within 41 ft. depth from the high-water level. The riser piper is 6 ft. in diameter. The tank is equipped with a "Chronoflow," consisting of a transmitter at the tank and a recording instrument in the main office, which at all times indicates the water level in the tank.

The contractors for the job were R. D. Cole Company, of Newnan, Ga. R. B. Simms is superintendent of both the water and sewer department. J. K. Marquis, engineer in charge of filtration and pumping, was the engineer for the project; and Lockwood, Greene Company, consulting engineers, retained in an advisory capacity for the work.

R. B. Simms, right, is in charge of the Water and Sewer Departments at Spartanburg

Garbage Disposal Into Sewers

By Guy E. Griffin
Sanitary Engineer, Greenwich, Conn

This material is extracted from a report by Mr. Griffin to his Board of Selectmen.

AS EARLY as 1923 some garbage was ground and discharged to the sewers of Lebanon, Pa., which terminated at a sewage treatment plant. It was observed that the ground garbage settled out fairly well with the sewage solids and digested fairly well.

No records of further work along this line have been found until 1932 when laboratory experiments were started by Keefer and Kratz at the Baltimore sewage works to determine in a scientific way if garbage could be digested with sewage solids, and if so in what proportions. They found that, with equal quantities of ground garbage solids and fresh sewage solids, on a volatile solids basis, added daily to a digesting mixture containing twenty times as much volatile solids and kept at a temperature of 85° F., digestion proceeded satisfactorily and produced an inoffensive sludge that drained readily. Greater proportions of garbage to sewage solids and to digesting solids in the mixture were not tried, but Keefer stated that, "it is doubtful whether quantities much larger than this can be digested with satisfactory results."

Somewhat earlier than this Professor Fair at Harvard University ran a laboratory experiment along similar lines but used a high ratio of 140 parts of garbage solids to 2 parts of fresh sewage solids and 1 part of digested sludge. Fair reports that practically no digestion took place and that the mixture became very acid. He further writes, "In the light of the results reported by Keefer and Kratz it would appear that normally the quantities of sewage solids are inadequate to satisfy the demands for good digestion of all the garbage of a community with its sewage solids."

Very recent experiments at the University of Illinois have been partly reported. Whitley reports that with equal weights of volatile solids of garbage and sewage, digestion was satisfactory, but when the proportion of garbage was greater than the sewage solids little digestion resulted.

Bloodgood at Indianapolis reports similar results but does not give very definite data on the proportions of garbage and sewage solids used. From the preceding references the proportion of garbage to sewage solids appears to be a very important consideration.

At Schenectady, Cohn also found similar satisfactory results in the digestion of equal parts of garbage and sewage solids. Laboratory tests indicated that sewage and food mixtures settled more efficiently than sewage alone due to the pulpy nature of food wastes causing a mechanical flocculation.

Plant Experiences

Lebanon, Pa. Mention has already been made of an early plant test at Lebanon, Pa.

University of Illinois. A more recent test in a plant of similar construction at the University of Illinois is reported by Professor Babbitt. The tests consisted of adding to an Imhoff tank for 250 persons, ground garbage equivalent to the production from 100 persons daily. After seven months of cold weather operation there was no sludge in the digestion compartment. The liquor was milky, highly acid and extremely offensive in odor. There was six to ten feet of scum in the digestion compartment and gas vents. Particles of garbage were still visible. Scum was also offensive in odor. The effluent from the tank was not satisfactory.

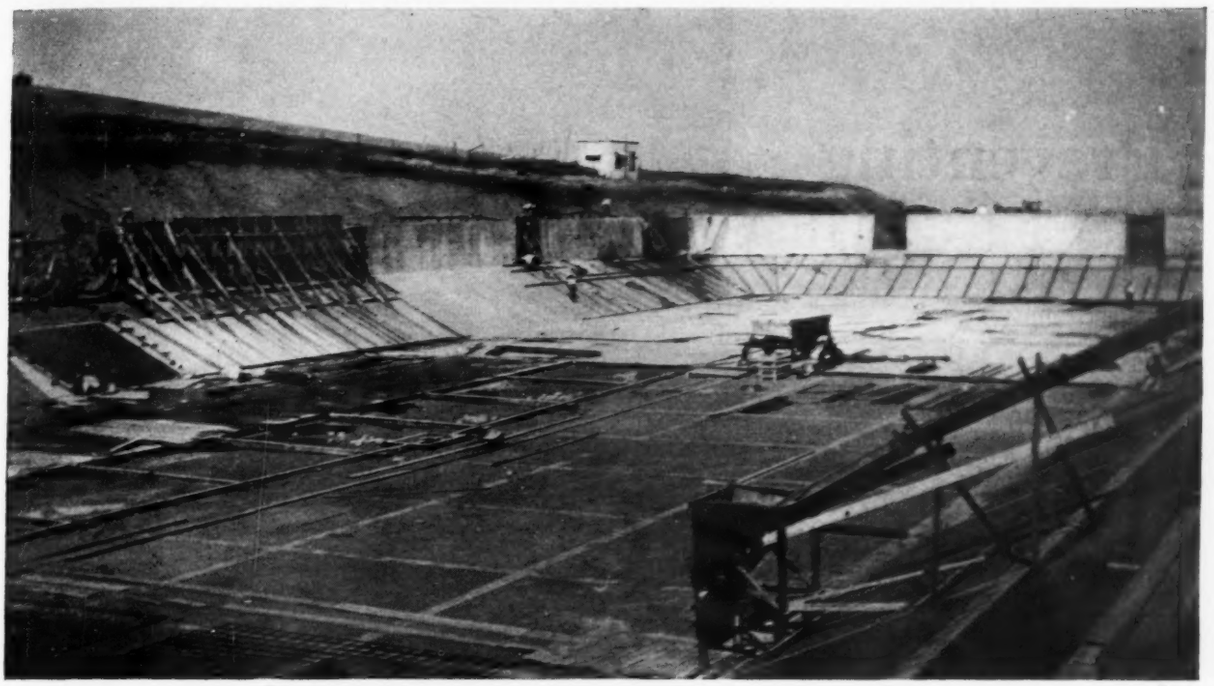
Baltimore, Md. As a result of the experimental work in this city, a grinding station was built in 1933 to dispose of the peak production of garbage to relieve an overloaded incinerator. The grinding station was operated for only 24 days from August 12 to September 27. An average of 70 tons daily was ground and flushed into a large sewer carrying a flow of 83 million gallons per day of sewage to a complete treatment plant. Keefer reports that the suspended solids in the raw sewage were increased, the oxygen demand was increased about 10%, the material that had to be removed from screens increased about 50% and that scum formation was increased on the primary settling tanks. The strength of the primary effluent apparently was not increased and no effect was observed on the trickling filters, digestion tanks and sludge drying beds. A computation here indicates that the ratio of volatile garbage solids to volatile sewage solids was less than 50%. The amount of garbage ground was about 20% of the total garbage production.

St. Louis, Mo. Part of the garbage of this city is disposed of into the sewers which discharge into the Mississippi River. No treatment plant is involved. This procedure is said to have been approved by the U. S. Army Engineers but disapproved by the U. S. Biological Survey.

Indianapolis. For about seven months beginning May 1, 1935, all the garbage of this city was ground and flushed into one of the grit chambers on the sewer leading to the complete treatment plant of the activated sludge type. A pump furnished 50 gallons per minute of raw sewage for the flushing. It was found desirable to pick out heavy bones, glass and metal to conserve space in the grit chamber. The grit contained more organic matter as well as coffee, nut shells, bone, egg shell, glass, china, metal, sand and cinders. Changes in the grinder reduced the amount of this material and the amount of skimmings from the tanks which were troublesome. The skimmings are burned in an incinerator for that purpose. Calvert reports some increase in sewage strength and at times a poorer effluent from the aeration tanks requiring more air. There was no interference with secondary treatment at other times. There was some indication of improved settling of sewage solids. The mixed sewage and garbage solids were digested in large open earthen pits or lagoons without difficulty. This plant is apparently isolated.

The Indianapolis plant has a rated capacity of treating 50 million gallons per day of strong sewage. The amount of garbage ground during the period stated

(Continued on page 13)



Constructing Six Million Gallon Reservoir at Corvallis, Oregon

Corvallis' Six-Million-Gallon Reservoir

By E. L. Strange
Engineer and Superintendent, City Water Works, Corvallis, Ore.

TWO years seems a long time to take in building a six-million-gallon reservoir, but the reason for such deliberateness in the case of our reservoir was as simple as A, B, C and several other letters of the alphabet. The work was started December 15, 1933, as a CWA relief labor project, confined to picks, shovels and wheelbarrows as equipment. After several months it was changed to SERA and then to WPA, with intervals between. The result was that excavation was not completed until June, 1935. Concreting was finished in October, and the reservoir was full and put into service on Christmas day.

The reservoir is on a side hill with a 3 to 1 slope, which made it necessary to move considerable material, including 45,000 cu. yds. of decomposed stone and boulders of various sizes, on which from 30 to 100 men were employed. As the excavation progressed and the distance the material had to be moved increased, it became evident that wheelbarrow hauling was too slow, and four dump cars of one-yard capacity were added to the wheelbarrows. These cars, run on steel rails and operated by small gas engine hoists, were used in this manner during the winter rainy season. When dry weather came trucks replaced the dump cars.

During the following winter of 1934-35 work was discontinued four months, and on May 1, 1935, a gas-driven ¾ yard shovel and trucks were employed to complete the excavation.

Pouring concrete was started about June 1, 1935, and this necessitated another departure from the original plan. For experienced concrete men, form carpenters and steel men were necessary but could not be found among the relief workers and the Water Department had to supply them at its own expense. The relief workers, however, prepared the ground for the concrete.

Although the reservoir was ready to receive water in October, 1935, backfilling and landscaping the grounds are still in progress, using 50 men on WPA pay.

The Water Department expected to supply approximately $32,000 of the cost but it had to furnish considerable of the skilled labor, as explained, and actually spent $52,000; which sum it had on hand.

The reservoir was full to overflowing and went into service on Christmas day, and the superintendent feels that the city water works got a fine Christmas present at a nominal cost with no bonds to be paid later.

Garbage Disposal Into Sewers

(Continued from preceding page)

averaged 94.8 tons per day. Computations indicate that during this period the ratio of organic matter in the ground garbage to that in the solids removed from the sewage was approximately 71%.

Durham, N. C. A relatively small amount of garbage was ground, discharged into the sewers and treated with the sewage at the new complete treatment plant of the activated sludge type with separate heated sludge digestion, during the summer of 1935. This was done to relieve an overloaded incinerator. This plant serves a population of approximately 30,000 people.

Kansas City, Mo. Most of the garbage of this city is fed to hogs. The balance is ground and flushed through the sewers to the river. The process of grinding garbage and mixing it with sewage does not meet with the approval of the Missouri State Health Department.

Grand Rapids, Mich. The experimental work of treating ground garbage with sewage in this city was so recently started that no reliable information regarding the effect on the treatment units is yet available.

Preventing Earth Slides in Seattle

The illustration at the right shows a slide encroaching on a highway

BECAUSE the city of Seattle, Wash., is located on layers or lenses of different kinds of earth material deposited by glaciers and rivers, the prevention and correction of earth slides has been one of its major engineering and financial problems. The slides are caused by the removal, by nature or by man, of the sustaining toe of one or more of the layers, and the saturation and lubrication of these layers by rains or by subsurface water. Each slide presents a separate and distinct problem, but the solution lies in drainage. When the subsurface water is removed, the lubricated plane dries up. Sometimes drainage is supplemented by the construction of bulkheads or retaining walls, but these alone are useless.

A recent WPA project in that city is designed to correct 33 slides. The work, which is under the direction of Major Mott Sawyer, WPA director, will employ 600 men for 10 months. The estimated cost is $518,542. Engineers in charge, in addition to Major Sawyer, include E. French Chase. sanitary engineer of Seattle, M. J. C. Andrews, his assistant, and Joshua Vogel. Dean R. G. Tyler of the University of Washington, built up a soils laboratory, with R. G. Hennes in charge. Dudley B. Eddy, Superintendent of Streets and Sewers, furnished soil samples. William J. Burns, field writer, has furnished us the data given below.

Plans for control are based on test borings and on study of surface conditions. In carrying out the construction of the drains, open trenches are used whenever possible. The average depth of trenches required on the Seattle work has been 22 feet with a maximum of 40 feet. Conditions sometimes require tunneling, with inverted well shafts connected to the tunnel. The depths of the trenches are governed by the depth of the sliding materials, plus from two to six feet into the hard lubricated material on which the slide is moving.

A pipe drain is then laid in the bottom of the trench with about one-half of the invert joint cemented. Every 20 or 30 feet a 12″ concrete dam is placed across the trench for the purpose of forcing the water into the open portion of the joints, and to prevent the washing-out of the material that is supporting the pipe. These dams extend from a foot above the top of the pipe to a foot below the bottom of the trench, and from six inches to a foot into the sides of the trench. There is always more or less of a movement of the sliding material, and it is absolutely essential that the pipes be placed at least 18″ into the hard material on top of which the slide is moving. This permits a movement of the earth above without breaking or disturbing the drainpipe or the drainage system.

The bottom of the trench is filled to a depth of four feet, and to the full width, with washed gravel, from ½ to 3 inches in size. A layer of straw is placed over the gravel, except for an area a foot in width adjacent to and parallel with one side of the trench and along its entire length. Over this portion the backfill is made with gravel to the surface, and the portion covered with straw is backfilled with the materials that were taken out of the trench. A 2″x12″x16′ plank with ropes attached to the ends is used to keep the gravel from mixing with the earth as the backfill is made. When the backfill is made up to the upper edge of the plank, it is pulled up about eight inches and the backfill is continued, with gravel on one side and dirt on the other. The gravel is always placed on the upper side of the trench for the purpose of intercepting all the underground and surface waters.

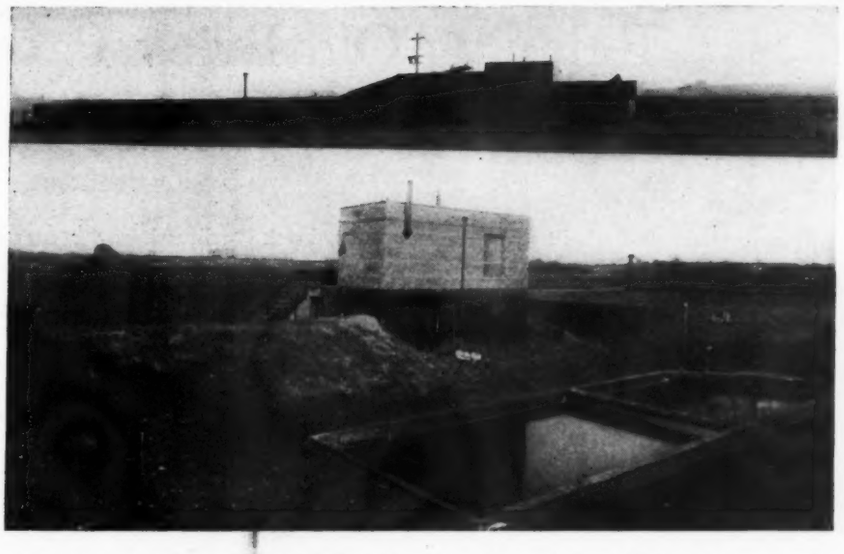
The effects of this type of construction are to dry up the sliding earth below the lower side of the trench. The water that was lubricating the plane on which the slide was moving is intercepted, and the moisture is removed from the sliding material. As this drying-out process continues the surfaces adhere and prevent further sliding.

The digging of trenches averaging 22 feet in depth in saturated moving ground is difficult and dangerous, particularly so when weather conditions are bad. To properly supervise this project, engineers with experience in this line of work are required. The foreman and some of the men working on the timbering and deep digging must be experienced in such work so as to protect the inexperienced men, and to make satisfactory progress with the work. A crew of about twenty men can work most advantageously.

Plans to start the work on most of the 33 slide areas have been made. To plan and organize the crews that are scattered throughout different parts of the city, and to provide for the necessary tools, equipment and materials, requires considerable engineering supervision, especially so, as the work is started, and plans are prepared as the work progresses. There are, in effect, 33 projects combined in one; and each slide is a separate and distinct problem.

Brookfield Sewage Treatment Plant

By W. B. Rollins



Top: General view of the plant. Bottom: View from the south-west, showing the south wall of the primary tank at the left, with pump house in the center, filter bed with rotary distributor at the right, and secondary or final settling tank in the foreground.

THE sewage treatment plant built last year for the city of Brookfield, Mo., which has a population of 6,500, is one of the most up-to-date plants that have been installed in that State by such a small city.

The sewage is chiefly domestic, the city being a railroad and farming community and a shoe company being the only manufacturing plant of any consequence. It was previously discharged untreated into a creek which normally had a flow sufficient to so dilute it that it could be used as a water supply for stock. However, in extreme low flows the water was so polluted that farmers threatened suits against the city.

The disposal plant was constructed as what is known as a non-federal project, the city voting $45,000 in bonds for the purpose and $14,000 additional being granted by the Public Works Administration. The plant cost $57,000, including $1,000 for the site.

The main features of the plant are a rectangular sedimentation tank, a trickling filter, and an insulated, heated digestion tank. Because of the slight fall from city to plant it is necessary to pump the sewage into the primary settling basin, and a pump house 20x22 ft. was erected, part of it three stories high. The lowest story contains a wet well and space for two 400 gpm. Yeomans sewage pumps and a sludge pump. On the second floor is a mechanically cleaned screen and hot water heater; and the third houses the laboratory and chlorinating apparatus and forms a deck along the side of the primary settling tank.

The raw sewage pumps are operated by float controls, the level of the sewage in the wet well governing their operation. Under normal flow, one pump will operate 40% of the time, the second pump starting when the flow is beyond the capacity of the first pump. Should the flow exceed the capacity of both pumps, because of a sudden downpour or high back water from Yellow creek, the plant will be cut off temporarily.

The primary settling tank is rectangular, 48 feet long, 15 feet wide, and 12 feet deep, with a hopper at the intake end 4 feet deep. The sludge is moved to the hopper by Link-Belt clarifier equipment, electrically driven through a manually operated switch, which also moves the scum to a discharge trough.

The dosing tank is 14 feet by 20 feet and is equipped with a Pacific Flush Tank Company siphon, which feeds a P.F.T. rotary distributor for the trickling filter, a concrete basin 120 feet in diameter and 7 feet deep, filled with 2½ to 1½ inch gravel.

The filter effluent flows into a secondary settling tank, 52 feet long, 15 feet wide and 7 feet deep. The sludge-removing equipment is the same as that furnished for the primary tank except that it does not skim the surface. The effluent from this tank is in a very satisfactory condition and flows to West Yellow creek in an open ditch, a distance of about 5,000 feet. The sludge from both primary and secondary tanks is pumped into the digester by a Yeomans vertical centrifugal sludge pump having a capacity of 50 g.p.m. and is dried on three fan-shaped sludge beds, each 50 feet long, 21 feet wide at one end, and 47 feet at the other.

The digester is 30 feet in diameter with 21 feet side depth, about 12 feet of which is below the general ground level. It is equipped with Dorr digester mechanism with sludge stirring and scum breaking arms, gas dome, inspection manhole and scum door. Approximately ¾ of a cubic foot of gas per capita per day is produced, of which about one half is used in a boiler (furnished by the Mueller Company) as fuel to heat water that is circulated through wrought iron pipe around the perimeter of the digester. To retain the heat, the concrete roof and also the side walls are covered with an earth fill.

The plant contains a W&T chlorinating machine with connections so arranged that chlorine can be added to the influent in the wet well just before the sewage is picked up by the sewage pumps, or just as the filter effluent enters the secondary tank, or at both places.

With proper attention this plant will produce an effluent that will comply with the standards of the State Board of Health, and its capacity is sufficient to handle Brookfield's sanitary sewage for many years.

The Public Works Administration was represented at Brookfield by H. F. Merker as resident engineer inspector. W. B. Rollins & Company, consulting engineers, Kansas City, Missouri, designed the plant and had charge of the work throughout its construction, and were represented at Brookfield by Swan McDonald as resident engineer. The Municipal Service Company, of Kansas City, Missouri, was the contractor and handled the entire construction with its forces. John O'Rourke and Walter E. Hamler were superintendents, at different times during construction, for the contractor.

Relaying Old Brick Pavements With Relief Labor

IT is common to find, in many communities, brick pavements which have given 25 or 30 or more years of service. Laid before many of the modern principles of highway engineering were known, some of these brick surfaces are now rough, though still serviceable. Taking up these old pavements and relaying them to provide new, smooth, modern pavements, gives employment to a considerable number of men.

This work may be organized under five or six principal heads: Taking up the old surface; cleaning and sorting the brick; repairing the base and preparing it for the new surface; rebuilding curbs and walks, changing crown, etc., where this is desirable; relaying the brick; and cleaning up.

Tearing Up the Old Surface

The size of the gang needed for this work depends upon the width of the street, and the type of filler with which the brick has been laid. With bituminous filler, picks, bars and occasionally bull-points will be sufficient to remove the old brick. When the pavement is frozen, or when the brick is grouted with cement mortar, gasoline or air hammers with chisels or points will be needed. In New York City, on recent WPA work, air hammers were used, though they did not appear necessary. A light hammer is ample for this work.

Care should be taken not to break brick, as blocks which appear even badly worn may be turned and used satisfactorily.

After the bricks are loosened, they should be picked up and piled along the street, or they may be loaded directly into trucks and hauled to the city barn or city yard for cleaning.

Cleaning and Sorting

As a rule, cleaning is entirely a hand job, that is, each brick must be taken by a workman and adhering filler removed with a hammer and chisel; a mason's hammer is often efficient. One engineer reports to us that throwing the brick into a truck, along with subsequent dumping accomplishes considerable cleaning. In severe winter it will pay to do the work inside, as it is easier on the men.

All unbroken blocks should be piled together to be hauled out to the street for relaying. It does not pay to attempt to save bats, or badly deformed brick, though on a street carrying only light traffic, brick may be used so long as one side is true and even. It is better to purchase the small number of new brick needed to make the job a really good one.

If the old street surface contained major irregularities, these should have been charted in advance of construction, and the base examined for defects after the old brick are removed. If such defects are found, due to lack of drainage, settlement over a trench or other similar cause, they should be repaired. Otherwise, the base or foundation should be examined, previous to relaying the brick, and corrections made so as to provide the proper cross-section and grade.

Standard practice should be followed in placing the sand cushion, as well as in laying the bricks and filling the joints. Detailed data, covering specifications and directions for construction will be forwarded to any reader on request to the Editor of PUBLIC WORKS.

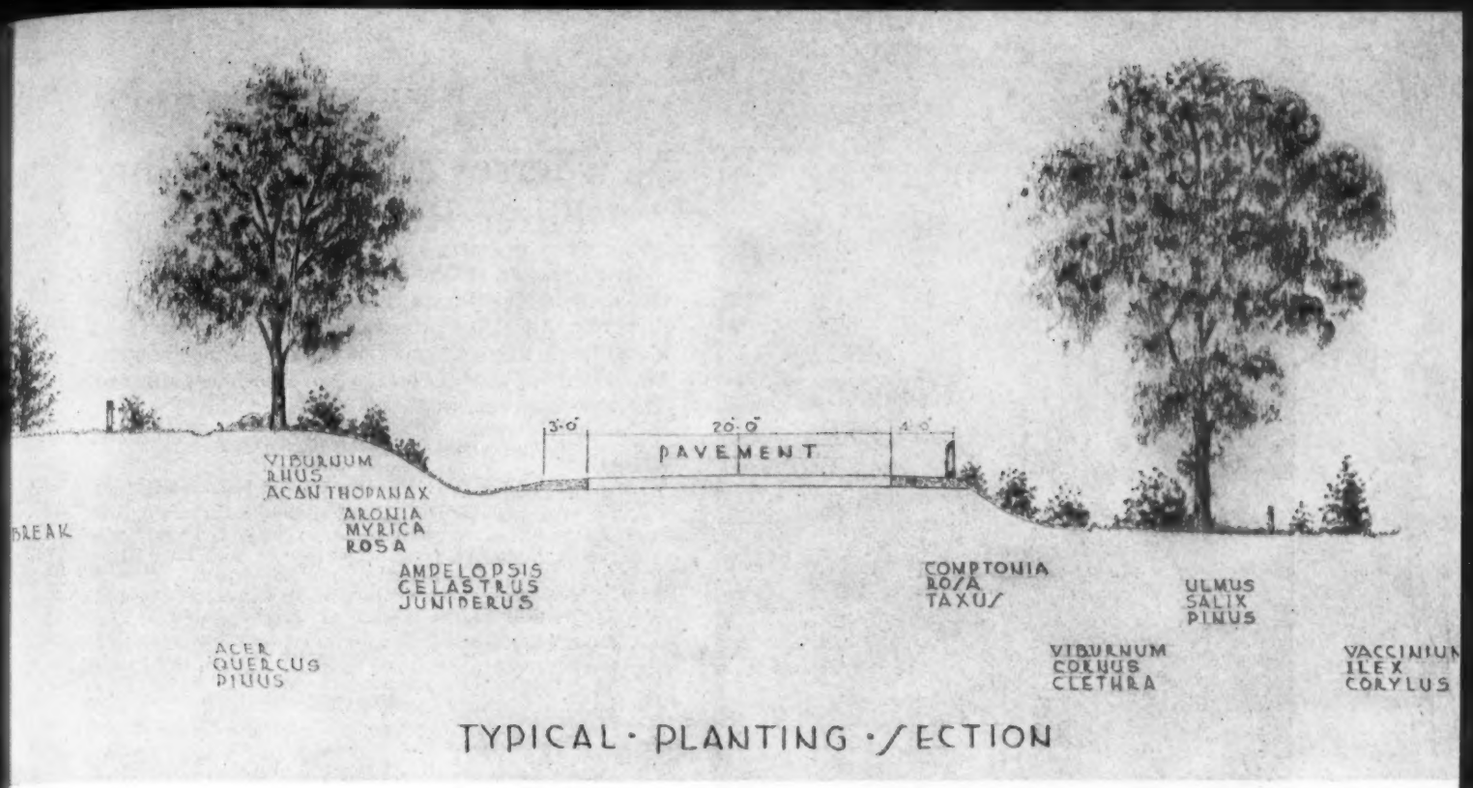
Work in Chicago

Nearly 5,000,000 square yards of this relaying of old brick pavements is under way in Chicago, Ill., where it is being carried out under a WPA project. M. J. Morrissey of the WPA recently described this work, as follows:

The brick pavements of Chicago comprise approximately 11,500,000 square yards. When the WPA program was originally written, the city was divided into 30 zones and 166,667 square yards of work to be done under this program was allotted to each zone. Work was started on October 25 and by November 15 we had 22 gangs of 150 men each at work on eleven locations. These gangs are worked on a two shift basis, six days a week, allowing us to use the full 30-hour week which is the maximum time that relief labor can be employed. One gang reports at seven a.m. and quits at noon, the other gang reporting at noon and working until five p.m. The brick pavers are union and furnished by the sponsor, the City of Chicago; the regular union eight hour day is worked by these pavers, that is, from eight a.m. until four thirty p.m. with the usual half hour for lunch at noon time. The furnishing of the brick pavers by the sponsor has been one of our stumbling blocks, because the original set-up was two pavers to a zone. We started out with one paver to a location, then two pavers, moved up to three pavers per location, and during bad weather have gone back again to two pavers. It is our hope when the inclement weather breaks to have four pavers per location. Our reason for going back to two pavers per location during this inclement weather is due to the difficulty in keeping ahead with the ripping out and cleaning gang. For the past two months we have had to use bull points most of the days, as the pavements were frozen so badly that bars could not be used.

At the start of the program on October 25 we did not have any contracts let for any type of material, so that we were buying material on an emergency basis, which is not to exceed $300 in any one day on one class of material. An emergency requisition, which in Chicago is limited to $300, had to satisfy the demands of all our superintendents on the eleven locations. The same thing was true of screenings and filler, but the filler situation became so bad that at one time we had 14,000 square yards of completed paving laid without filler and were receiving only 2,250 gallons of filler per day.

The present program on brick relay covering only six of the city's thirty zones has gone so successfully that we are now considering the immediate expansion of the program to cover relaying brick in other parts of the city. Up to the present date we have completed 130,000 square yards of pavement and think we are educating our unskilled labor from the relief organizations, so that when we put out additional gangs on other locations as contemplated in our new set-up, we will be able to provide each gang with trained workers in the key positions.



Roadside Improvement Work in Maine

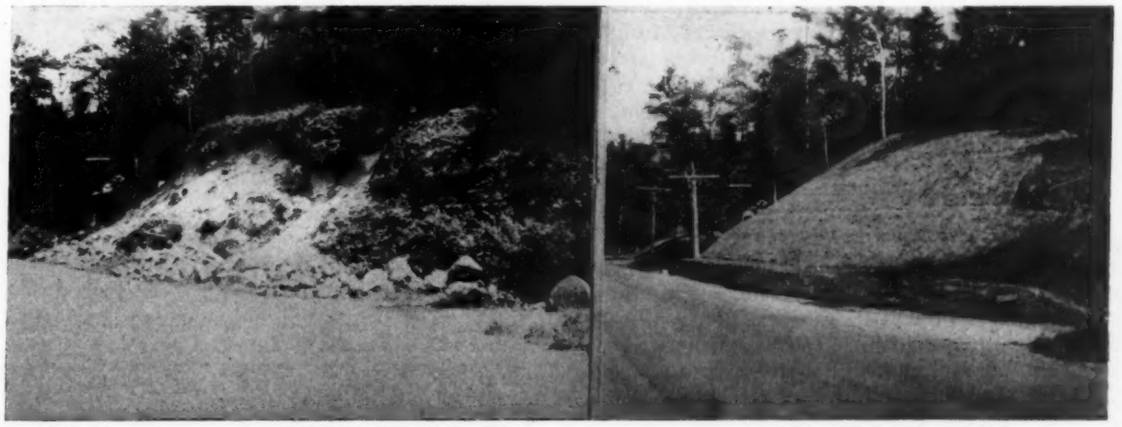
By Ernest L. Merrill,

Assistant Engineer Maine State Highway Commission

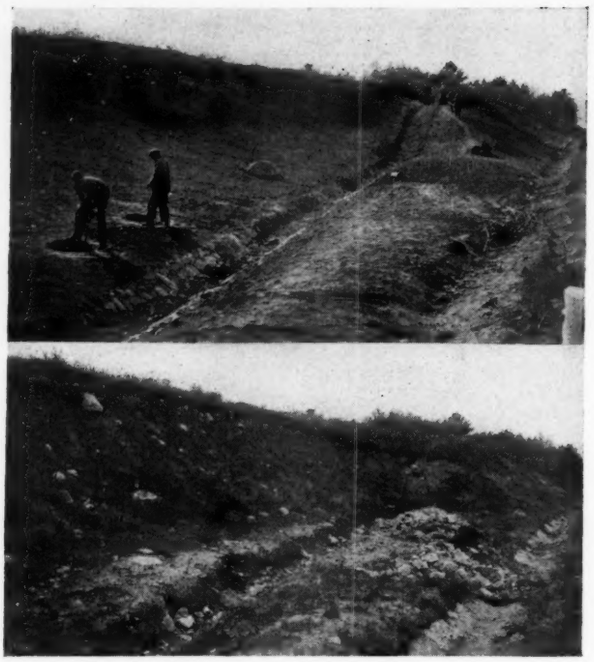
FOR about twenty-five years Maine has carried on a steady highway construction program. This has necessitated straightening, widening, easement of grades and a great deal of new location. The result has been raw unsightly slopes which on account of erosion have increased maintenance costs; and not only that, but the passing motorist has judged unjustly the scenic surroundings.

The need of roadside improvement has been felt for some time and four years ago the Maine Legislature passed a Roadside Improvement Bill giving the State Highway Commission authority to plant and maintain grasses, shrubs, trees, etc., along state and state-aid highways. While the appropriation was comparatively small, nevertheless it was felt that it was a start in the right direction and as the traveling public became acquainted with the results, a larger appropriation would be forthcoming.

During the past two years Maine has been actively engaged in this new branch of highway work and has endeavored to improve its roadsides by planting and maintaining trees, shrubs, and ground covers; rounding and seeding, sodding or planting slopes through cuts; removing underbrush and slash through wooded areas; creating or opening up scenic vistas by plant arrangement or by clearings; constructing triangular parks at road intersections; sodding and constructing diversion ditches and slope drains to prevent erosion; constructing suitable picnic grounds with adequate facilities to enjoy them; healing construction scars by planting, or regrading, or both, around old borrow, sand or gravel pits; screening unsightly views from the highways by



Before and after improving the slope of a roadside bank to prevent washing, slides, and high maintenance costs



Lower illustration usual borrow pit appearance; above is shown grading, planting and other work to make roadside attractive

proper plantings; providing parking and rest spots for motorists both for convenience and as a safety measure; trimming roadside trees where necessary to reduce the dangerous hazards of traffic tie-ups and accidents caused by wind and sleet storms; removing trees and scrubby growth from the inside of sharp curves to provide better vision; and in general creating a neat appearance all along its roadsides.

Maine's diversification of scenic beauty has in itself solved the treatment of its roadsides. In general, native plant materials are used in an effort to blend the roadsides harmoniously into their surroundings. Near towns, cities and triangular road intersections more formal treatments are appropriately used.

With Federal funds this state has improved fourteen miles during the past season and is planning for improvement of approximately twenty-five miles for the present year.

In addition to Federal funds, the surplus revenue over and above the administration of a recent law taxing all forms of outdoor advertising, and a designated state fund appropriated yearly, will be used in an effort to afford the motorist a more truthful perception of Maine's admittedly unsurpassed natural beauties.

Roadside improvement work is handled by the construction division under the general supervision of Ernest L. Merrill, Assistant Engineer with Kenneth Brown as Landscape Engineer.

De-aerated Concrete

De-aeration is effected to some extent by vibration in the forms, but to obtain good results prolonged vibration is necessary. A process for de-aerating concrete in the mixer consists of rapid rotation of the drum for the purpose of mixing and then of slow rotation and vibration. The concrete when placed may be subjected to a further short period of vibration. Higher concrete strengths are stated to have been obtained as a result of the de-aeration process.—Highway Abstracts, from *Rev. Mat. Constr.*, 1935 (308), 130-1.

New Jersey's New Sprinkling Filter Requirements

In November, 1935, the Department of Health of the State of New Jersey changed its rules and regulations relating to the preparation of designs for sprinkling filters, the most important change being the great increase in volume of sewage per acre-foot permitted. The new requirements are as follows:

Requirements as to Sprinkling Filters

General:

1. Sprinkling filters shall be preceded by efficient sedimentation.

2. The minimum effective depth of filtering media at any point in the filter shall be not less than six (6) feet and the preferable maximum depth shall not be more than nine (9) feet. The effective depth shall be the distance from top of stone to top of underdrains. The effective volume shall be that volume that complies with the aforesaid effective depth.

3. The filtering media shall be from one (1) inch to two (2) inches in size; free of fines, and the crushed stone shall comply with the sodium-sulphate soundness test prescribed by the American Association of State Highway Officials.

4. Means for the complete flooding of the filter by sections are desirable.

5. Underdrain ventilation shall be provided.

6. When the 5-day Biochemical Oxygen Demand of the raw sewage exceeds 325 parts per million, sprinkling filter treatment is not desirable unless preliminary sedimentation is supplemented by an additional method of treatment, such as chemical precipitation.

(a) The volume of sewage to be treated by a sprinkling filter shall not exceed 630,000 gallons per day per acre per foot of depth.

(b) The average rate of application of sewage during the dosing period shall not exceed either of the following:

(1) 1,100 gallons per minute per acre per foot when the 5-day Biochemical Oxygen Demand of the raw sewage is equal to or less than 215 parts per million.

(2) 215 ÷ 5-day Biochemical Oxygen Demand raw sewage × 1,100 gallons per minute per acre per foot when the 5-day Biochemical Oxygen Demand of raw sewage is greater than 215 parts per million.

(c) The operating time of the filter shall be not less than 20 per cent or more than 40 per cent of the day.

Secondary Tank:

1. Sprinkling filters shall be followed by a settling tank; if flat bottom, two compartments shall be provided. Total detention period, based on average daily flow, shall be not less than one (1) hour. Consideration should be given to supplementing sedimentation by chemical precipitation and to the installation of mechanical sludge collection equipment.

2. Sludge disposal from secondary tanks.

(a) If separate sludge digestion tanks are provided, the sludge from the secondary tank shall be discharged thereto, and a volume of not less than one-half (½) cubic foot per capita shall be provided for this sludge.

(b) If separate sludge digestion tanks are not provided, the sludge from the secondary tanks shall be discharged to glass-covering drying beds and the area provided therefor shall be not less than one-quarter (¼) square foot per capita. otherwise, the matter of secondary tank sludge disposal shall be considered as a separate problem at each installation.

(c) If pumping is necessary, the piping and pumping equipment shall be a permanent installation.

Fixed Nozzle:

1. Twin dosing tanks shall be provided and they shall have a common nozzle field.

2. The dosing cycle (the time interval to completely fill and discharge one siphon chamber) shall not exceed fifteen (15) minutes.

3. The net terminal head on nozzles shall be not less than one and one-half (1½) feet.

4. Half nozzles or equal shall be provided at the sides of the filter bed.

5. Detailed information shall be furnished in regards to the coverage efficiency of the nozzles.

6. Consideration should be given to means which will permit the removal from service of either half or any quarter of the nozzle field.

Rotary or Traveling Distributor:

1. The filter retaining wall shall not extend more than three (3) inches above the filtering media.

2. Valves shall be provided to permit cutting out of service any filter unit.

The Editor's Page

Providing Equipment for Next Winter's Snow

Here in New York City—and we presume that the same is true in almost every other city in the snow belt—there has been a lot of unjust criticism of the men in charge of snow removal. The breaks have been against them; with zero or sub-zero weather coming with the first snowfall, and persisting for an unusual length of time, snow removal as many of us would like to have it has been impossible.

For the most part, in the cities we have visited, the men charged with snow removal have done their best. But that best has not been adequate under the circumstances. No small part of the fault has been due to the fact that, in the lean years just past, cities, counties and states alike have failed to replace wornout and inadequate equipment. As a result, when the test came, equipment failed. And that failure threw an undue burden on men—a hopeless burden.

In one city, three of five large trucks used on snow removal were back in the garage for major repairs within ten hours after going into service. New units were ordered at once, but "arrived too late to be of help on this job, but should help next year."

Preparedness is just as important in municipal, county and state affairs as it is in national defense. Now that the winter storms are about over, it is a good time to make a critical examination of snow-fighting equipment, and prepare for next winter. Many students of meteorology believe that severe winters, as well as rainfall deficiencies, occur in cycles; and if this is the case, we are probably in for a number of "good old-fashioned winters," and the officials who wish to forestall a series of repetitions of this year's criticisms will prepare themselves to handle snow similar to that which they have recently struggled with. Moreover, just now they will probably find the handlers of the public purse strings more receptive to suggestions of such purchases than they have been for many years.

Public Aid in the Advancement of Sewage Treatment

It is generally admitted abroad that the United States has made more progress in sewage treatment during the past decade than any other country. Much of this credit is due to three classes of of investigators—firms dealing in equipment and chemicals, cities which have operated testing plants and laboratories and investigators connected with engineering schools. Minor improvements which, however, bulk large in the aggregate are to be credited to engineers and operators of treatment plants.

The aim of the first class is, quite naturally and properly, to recoup the cost of their investigations and experiments by sale of their products; improvements which do not involve such sales can not be expected to interest them. Several large cities—notably Chicago and Milwaukee—have carried out thorough investigations of principles, procedures and equipment which have been of uncalculable (and not fully appreciated, we fear) benefit to all classes interested in sewage treatment, at the cost of hundreds of thousands of dollars. The results of these investigations, valuable as they are, are based upon local conditions and may or may not have general application; and cities which can not afford to conduct such investigations are denied the benefits which they would yield. The studies made by engineering faculties are not limited by commercial or local conditions, but are generally hampered by lack of adequate funds.

It seems to us that the greatest benefit would accrue if such investigations were conducted by State or Federal government scientists, in plants so located as to permit studying the effects of variations in climate, character of water supply, of commercial wastes, etc. At least, the health boards of the various States should encourage such investigations by advice and by money when possible, which money should be provided adequately by State appropriations.

Instead of this, we find many State health boards so conservative (or timid or perhaps even mentally sluggish) that they do their best to discourage departures from well-worn ruts; and where their approval of plans for municipal plants is required by State law, they are able to pretty nearly shut out all such departures and "block the wheels of progress." One developer of a sewage treatment process writes us that he has interviewed twenty-two state boards of health and that nineteen of these wish to delay any approval until someone else has tried out the process—though at least one plant using his process has been operating successfully for two years or more.

This reminds us of the city council which decided to prevent any chance of accident at a point where two railroads crossed. They passed an ordinance "that, when two trains approach the crossing, neither shall proceed until the other one has cleared the crossing."

Letting George do it is no way to progress.

Center Planting for Safety on Highways

A parking strip—center grass plot or landscape planting—at least 3 or 4 feet wide, dividing a roadway into two one-way sections, each wide enough to permit passing, is recommended by the Bureau of Public Roads as a safety measure. It would undoubtedly add greatly to the safety of both wheel traffic and pedestrian, since a car could pass without the danger of colliding with another passing in the opposite direction, and pedestrians crossing the road would have to watch but one line of traffic at a time and could stop on the center strip for a breathing spell between dashes.

Such a strip 3 to 10 feet wide would add little to the cost of new construction. Placing one in an existing pavement brings up the question of width. In the case of a 4-lane pavement it might necessitate adding three feet to the present width. Three-lane pavements are an abomination and should be widened anyhow, and in doing so the center strip could be added at a cost well worth while in view of the additional safety secured.

If five feet or more wide, shrubbery and trees in this strip will add greatly to the attractive appearance of the road, whether or not the roadside also be planted.

Equipment Used in Water Purification

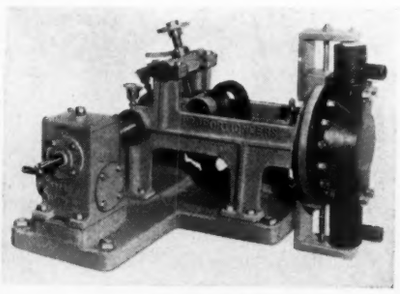
Handling Chemicals

Solution Feeders (Continued)

THE feeders described deliver at a constant rate until readjusted. Apparatus is available which automatically varies the dose with the amount of water being treated; and recent developments make it possible to automatically vary it with change in certain characteristics of the water being treated.

The "American electro-magnetic chemical feed" is operated by a water meter through which the water to be treated passes; and to which a mercury switch is so connected that, for every certain number of gallons passed, the mercury switch makes and breaks an electric circuit to the proportioner, energizing a magnet which pulls up an armature, rotating the control sprocket on the proportioner a definite amount, which in turn lowers the take-off pipe into the chemical tank, thus drawing off a certain amount of chemical; the amount being variable by means of a vernier adjustment of the amount of lowering of the take-off pipe. Two or more chemicals can be so controlled from one meter.

The "Tret-O-Unit" is operated by any meter, venturi or other, or by the pump which pumps the water, which operates the gear of the appliance, which in turn translates this into fluid impulses; which impulses are conveyed to any desired point, where an impulse motor regulates the stroking rate of one or several feeders, which may feed either dry or liquid chemicals. Several special solution feeders are offered — the chlor-o-feeder and ferr-o-feeder, for ferric chloride, hypochlorites, etc.; a midget chlor-o-feeder feeding a solution at any rate up to 1/40 gal. per minute. These are variable-stroke, positive-displacement diaphragm pumps, operated by water under pressure from a water distribution system, or by electric motor from a light socket; the delivery being regulated minutely by adjustment of length of stroke. Dry feeders can be controlled by use of a "positioner."



Ferr-O-Feeder

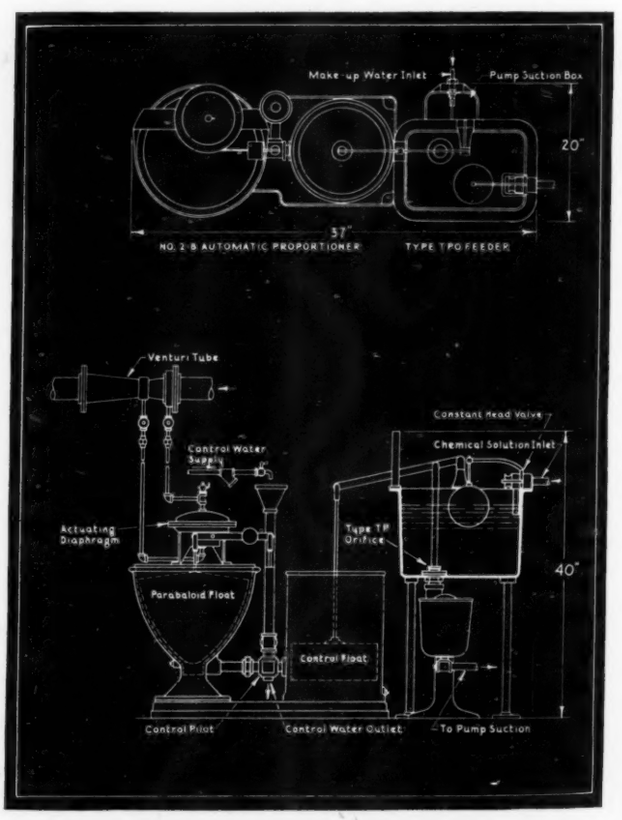
The "International" automatic proportioner is operated by the differential pressure between inlet and throat of a venturi meter. This operates a diaphragm, which is connected by suitable linkage to a paraboloid float and a pilot valve; which valve controls the admission of water to or drainage from both the paraboloid float chamber and a chamber holding a cylindrical float; the effect being to cause this float to rise or fall in direct proportion to the rate of flow through the venturi; which rise and fall is used to regulate the rate of discharge of a feeder.

Much simpler and perhaps more generally useful are the devices available by which, although the feed of chemical is uniform until the feeder is reset manually, the feeding automatically begins and stops at the same time the flow of water does.

Appliances which have been used but still need development to become commercial possibilities include one which automatically measures residual chlorine in treated water and controls the rate of feed of the chlorinator so as to keep it at a fixed point without any human attention; another measures electrically the effect of lime treatment on water which is being softened, taking the place of frequent chemical tests; another automatically adjusts the dose of coagulant to correspond to the turbidity of the water, through the medium of the photo-electric cell.

Accuracy of delivery by any of the above appliances is probably as great as is really important (guaranties of limit of error varying from 1% to 5% are offered), but equally important is accuracy of strength of the solutions delivered. These are prepared in mixing tanks, and may be fed direct from these to the feeders, or run into solution tanks first. If there is only one tank, feeding must be stopped whenever a new batch is being mixed. The only accurate way is to make the solution in batches. But in some cases water is run continuously through a tray of the chemical and the strength of the solution estimated, or tested from hour to hour.

In choosing a feeder, consideration should be given to the kind and amount of chemical to be fed; the relative importance of accuracy (in most cases reliability of uninterrupted service is more important than minute accuracy); the amount and skill of the attention the plant will receive; the space available; and the cost. As to amounts; in general ½ to 3 grains of lime per



International solution chemical feeder with automatic proportioner

gallon is used as a coagulant, 5 to 15 grains for softening; of soda ash, ½ to 3 grains as coagulant, 3 to 10 for softening; 1 to 5 grains of either alum or iron sulphate; ½ to 3 grains of sodium aluminate; ½ to 2 grains of ferric chloride; hypochlorite, HTH or perchloron, 3 to 5 lbs. of available chlorine per million gallons; ammonium sulphate, 4 to 10 lbs. per mil.-gal.; activated carbon 10 to 50 lbs.; copper sulphate, 7 to 10 lbs.

In distributing copper sulphate in reservoirs or lakes, accurate adjustment of dose to the volume of water it reaches is impossible. Probably the nearest approach to this which is practicable is to compute the entire volume of the body of water and the total amount of copper sulphate required for giving the desired rate of dose, then distribute the amount as uniformly as possible. Generally this is done by putting the sulphate in a burlap bag and towing it behind a boat, which weaves back and forth across the body of water, covering it from shore to shore once, then again in courses at right angles to the first. Row boats are often used, but a "kicker" probably helps better to mix the solution with the water. A recent variation is to powder the copper sulphate and spread it over the surface, as by a sand spreader towed from a boat. Shallow edges of the water, where the boat cannot enter, should not be neglected; these may be sprayed by equipment used for spraying trees, or that used in anti-mosquito work.

Feeding Chlorine and Ammonia

Chlorine and ammonia gases are supplied in cylinders under considerable pressure, which pressure decreases as the cylinder empties or as the temperature falls. Special measuring and feeding equipment is necessary, therefore, in applying these gases. The doses may be very small—as low as 0.05 lb. per day—and the equipment must therefore be comparable to laboratory apparatus.

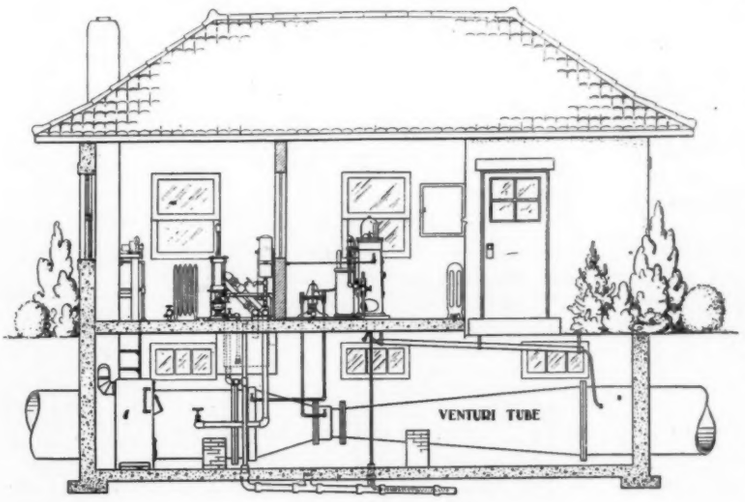
Either chlorine or ammonia may be fed directly as a gas, or first combined with water. Ammonia is readily soluble in water and can be applied more easily by direct feed than by solution feed. With chlorine, however, solution feed gives better diffusion in the water, greater efficiency, substantial saving in chlorine and better operating conditions, and is preferable where water pressure is available. This pressure must be at least ten pounds for gravity feed, or, if applied against pressure, three times that pressure; this pressure being obtained by a small pumping unit where it is not available in the water supply.

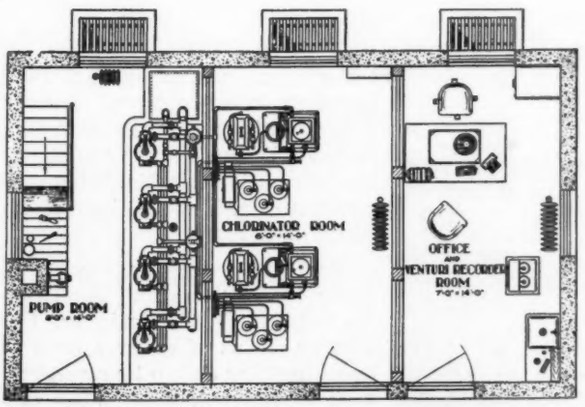
Modern solution feed chlorinators are usually of the vacuum type. This designation is used because the chlorine gas is metered under a partial vacuum, the vacuum being produced by a water operated injector which also serves the purpose of conveying the chlorine solution to the point of application. Direct feed equipments are of the pressure type, the injector being omitted. For direct feed, the temperature of the room should be kept above 32°; for solution feed, above 50°. In W & T solution feed chlorinators, small quantities are measured volumetrically; larger quantities (over 5 lbs. per 24 hrs.) by orifice.

The direct feed ammoniator operates in a manner similar to the direct feed chlorinator.

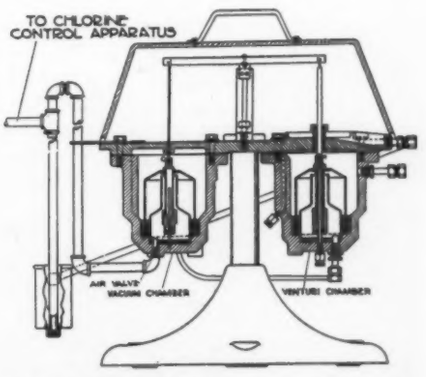
For small amounts, the rate of feed by a chlorinator is generally adjusted manually. For treating large amounts of water which vary widely from hour to hour, automatic regulation of feed in proportion to amount of water treated is economical, and is secured by means of an additional unit —a differential converter, control of which is effected by means of a venturi meter, a pitot tube, flow orifice, flow over a weir, or submerged orifice. The venturi meter is the one most generally used.

For feeding very small amounts of prepared sterilizing solutions, Wallace & Tiernan furnish a "chloroclock," which supplies the solution at a uniform rate by means of a displacement feeder; or a "chlorometer," which is attached to a meter

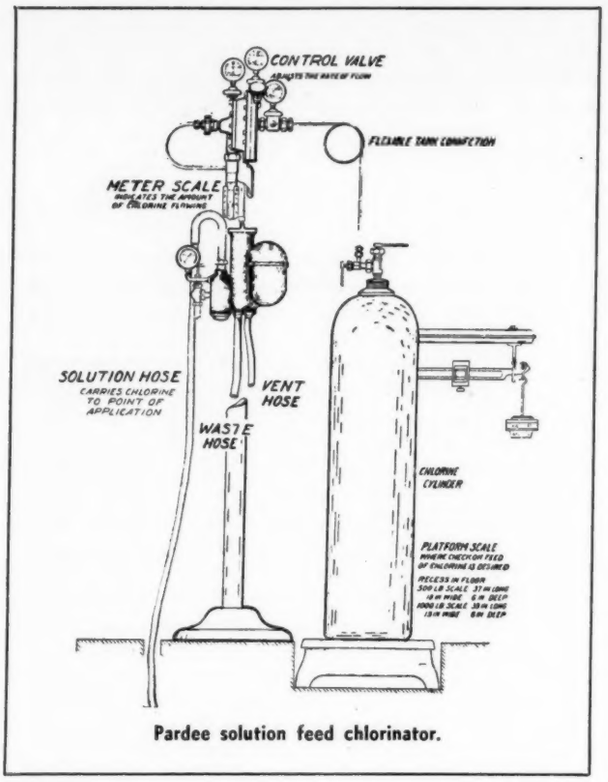




Installation of duplicate vacuum chlorinators with venturi automatic control, applying chlorine to a gravity main



W & T differential converter (venturi type) for automatic regulation of chlorinator feed



Pardee solution feed chlorinator.

through which flows the water supply being treated; the dose of chemical thus being proportioned to the flow.

A continuous record of the rate of feed, made on a standard circular chart, may be obtained by attaching a "chloro-scale" to a standard platform scale on which the chlorine cylinder stands.

Chlorinators and ammoniators operating on the general principles described for manual control are furnished by Wallace & Tiernan, the Pardee Engineering Co. and the Filchlor Co.

By the Marsh electro-chlorination system or Everson electric chlorinator, brine and electric current passed through an electrolytic cell produce sodium by hypochlorite, the amount made being controlled by regulating the amount of current. The hypochlorite is fed directly to the water. They are used chiefly for swimming pools.

Aeration

Aeration in water treatment is employed either for oxidizing matters in solution or suspension, such as iron, or for removing taste-producing or other objectionable gases carried by the water, or both. It is effected by passing the water through the air as a spray (as from a nozzle or atomizer) or agitating it so as to bring all parts into contact with the air (as in discharge over a riffle), or by passing air in bubbles through the water.

Among the devices used for aerating water are: One or more riser pipes in a reservoir inlet, ending above the surface and generally provided with a spreading apron, often containing steps. Irregularities in the channel by which the water enters a reservoir, such as baffles, steps, protruding stones set scattered in a masonry bottom, iron plates set herring-bone fashion in the bottom. A series of coke trays, one above the other, through which the water passes in drops from each to the one below. A series of pans, one above the other, increasing in size downard, the water flowing in a thin stream over the edge of each pan to the one below. Nozzles through which the water is sprayed into the air, generally to a height of 10 to 25 feet. The last is considered the most efficient, but requires the most head. The nozzles generally are from 1 1/16 to 1⅜ in. orifice. As high as 1,600 are used at one point (Kensico Reservoir, New York City), aerating 400 mgd.

For passing air through the water, diffusion pipes or plates in a tank, operated similarly to the aerator flocculator (see January issue) are used by a number of cities, aeration for about 15 minutes being the average period. In this there is no loss of head of water, but compressed air is necessary. By installing, in the tank, a row of tubes, in units of two tubes each, any unit or units can be shut off at will. A diffuser medium of 35 to 40 permeability is recommended. The air used averages 0.07 cu. ft. per gallon of water aerated. Centrifugal or positive displacement type blowers are recommended.

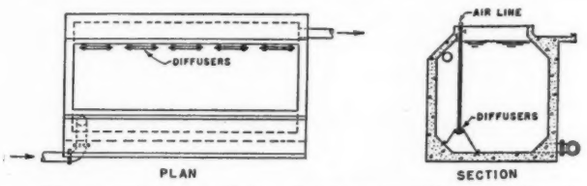


FIG 1. PETERSBURG, INDIANA. WATER PURIFICATION—AERATION AND MIXING

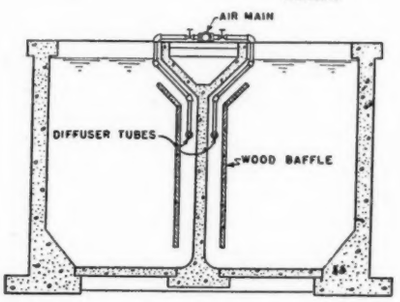


FIG. 2. CROSS-SECTION OF BROWNSVILLE UNIT ELEVATED DIFFUSERS

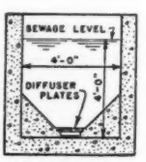
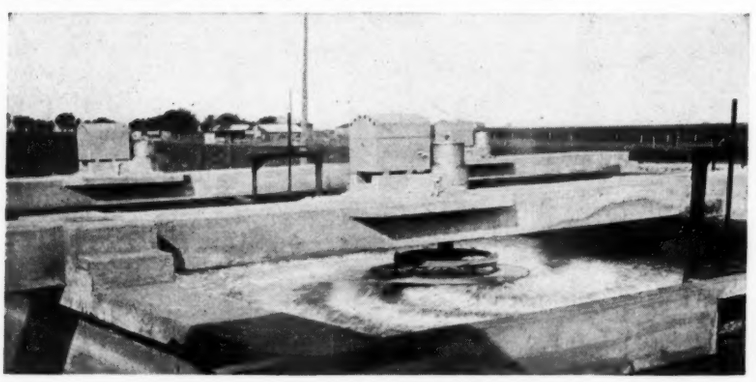


FIG. 3. TYPICAL DIFFUSER INSTALLATION IN CHANNEL



Simplex Aerator in operation at Fredericks, Oklahoma.

Aeration is also effected by air-lift pumping. Where removal of gases is desired, discharge of the water into the open air before pumping to the distribution system is desirable. Where the water contains iron, it should be filtered before being distributed.

Another device for mixing air and water is the "aeromix" described under the head of chemical mixing. This operates by means of either a head of water or an impeller driven by a vertical motor; with the latter there is no loss of head.

(To be continued)

A Review of the Present Status of Refuse Disposal

EXISTING conditions relative to refuse disposal were summarized in a report made to the Sanitary Engineering Division of the American Society of Civil Engineers by the Committee on Technical Aspects of Refuse Disposal. The leading features of this report are abstracted below.

No process is known to be regularly in use for destructive distillation of garbage for recovery of gas, charcoal, tar products or alcohol.

Digestion of garbage with sewage solids has been practiced recently to a certain extent at St. Louis, Lebanon, Pa., Baltimore, Indianapolis and other cities. The ground garbage is discharged into sewers or preliminary sedimentation or sludge digestion tanks, to be treated like ordinary sewage or sludge.

The *Beccari* process is used in about a dozen plants in Italy, and in Scarsdale, N. Y., and a few Florida municipalities, but nowhere else in this country.

Dumping at sea is practiced by three Pacific coast cities and several on Atlantic coast. Sea dumping by New York City has been stopped permanently by order of the U. S. Supreme Court.

Dumping into rivers by individual and manufacturing plants is in common local use. Beginning in 1935, the garbage of St. Louis has been ground and discharged into the sewer and by this into the Mississippi river; which process has been approved by the U. S. Army Engineers for St. Louis. This is the only case known where garbage is reduced to fine particles before discharge into a body of water.

Burial of garbage is not practiced as an organized municipal activity in any municipality of which the committee has knowledge, although it is a common practice by householders in communities where there is no organized collection.

Filling waste land, quarries, etc., without covering the freshly placed refuse, is used in many communities for all classes of municipal refuse.

Fill-and-cover (sanitary fill) has been used by 14 cities on the Pacific coast of more than 10,000 population (possibly some others), of which 9 use it for mixed refuse, one for garbage, 2 for non-combustible refuse, and 2 for combustible and non-combustible refuse.

Feeding to hogs continues to be by far the most widely used method of garbage disposal. Within 12½ miles of the city of Boston there were 105 hog farms in operation in the year 1925, and the number of such farms is probably not materially different today. Gillespie and Reinke state that, of the 53 cities of over 10,000 population in British Columbia, Washington, Oregon and California reporting in a 1934 survey, 52 practiced hog feeding for garbage. (Included in this number are 9 cities reported as disposing of "mixed refuse" by hog feeding.)

Hog feeding is not a method of complete disposal of garbage. The uneaten garbage, manure and bedding aggregate in weight about 1/3 to ½ of the weight of the raw garbage delivered to the farm. The residue, which is much more offensive than the original material, may be disposed of either by plowing it into the soil as a fertilizer as soon as it is produced, by storing it in compost heaps for subsequent use as fertilizer, or by burial. With any of these methods, the dissemination of odors is likely, unless extreme care is exercised. A method which the chairman has used in a full-size experiment and which has been considered for several large-scale projects is an adaptation of the reduction process. Another method which has been considered is incineration with municipal rubbish, the latter providing the additional heat required.

Reduction of municipal garbage is practiced at the present time by 14 reduction plants. The only new one built recently is at Philadelphia, although the Indianapolis plant was substantially reconditioned in 1935, following an explosion in one reducer. In addition to these municipal plants, there are a few small plants in hospitals and institutions.

Incineration (burning garbage, rubbish or mixed refuse, either with or without ashes, dead animals and street sweepings) is probably practiced in between 650 and 750 municipalities in this country and Canada at the present time.

Present trends in disposal methods. Until the rise in pork prices of the last two years, there appeared to be a definite interest in changing from hog feeding to incineration. The high price of pork has tended to check this trend, although the greatest check is due to the present economic situation of our municipalities.

In the first PWA program, 12 municipal incinerators were included, with an equal number in the second program. There is active interest in the construction of a number of additional incinerators.

While there is much discussion among sanitary engineers in regard to the disposal of garbage with sewage, it cannot be said that there is any marked trend toward adopting this method of disposal on the part of the municipalities.

Trend toward municipal disposal. In the early 1930's there was a widespread interest in abandoning municipal collection and disposal services and substituting contract services, financed by the municipalities, as a result of the wave of enthusiasm for economy. The meager reports available do not mention any continuing interest in this direction but do indicate some interest in changing from contract to municipal operation.

At that time, when there was some difficulty in floating bonds for capital expenditures, there was also some interest among cities in awarding contracts or franchises for the construction and operation of incinerators, the plants generally to become the property of the city after a period of years. In most cases these contracts were not executed.

European Methods

In Europe, the common practice is to place all classes of waste in one household container. As houses are seldom heated by central heating plants, much less

ashes is collected than in this country. Cartons and other containers of merchandise are much less abundant, as are old tires and other wastes from motor cars. And in general there is greater national thrift. However, there is a tendency in northwestern Europe to approximate more nearly to United States conditions in this respect.

Perhaps the most interesting method of disposal in Europe is "controlled tipping," which is used extensively in England and to a less degree elsewhere. The practice in controlled tipping is laid down quite definitely by the Ministry of Health in its tipping precautions issued in 1922. Quoting from an article by J. C. Dawes, Inspector of Public Cleansing of the Ministry of Public Health:

"Very briefly, the underlying principles require dry refuse to be deposited in shallow layers not more than 6 feet in thickness and wholly covered in 24 hours with soil or other non-combustible material, so as to form an effective seal. The whole of the refuse can be put into the tip, but it must be packed very carefully. There must be no cavities. The front of the tipping face must be kept narrow, where practicable not more than 20 feet, to facilitate daily covering."

This is a biological process in which a temperature of fermentation of 150° F. is aimed at for a period of 20 to 30 days, although considerably higher temperatures have sometimes been reached. Careful packing of refuse means flattening out of paper cartons and tin cans and breaking of bottles (which would be expensive with American wages).

In many municipal installations, before incineration, the refuse is passed through screening equipment for removal of the large amount of fine (less than 5/16 in.) dust, which in London runs as high as 28% in winter. In some cases the fine material is used on heavy land, where its value for lightening the soil may be perhaps more important than its fertilizing value, and in other cases for making the "London stock" brick. The removal of this material substantially reduces the capacity required in incineration equipment and the cost of operation of the incinerator.

In 1927-1928 over two million tons were disposed of by incineration but the figure now has fallen to about 1,600,000, and Dawes says that "comparatively few new plants are now put down to operate on the direct incineration principle, although one can visualize refuse analyses which might justify this method."

Many cities find disposal of clinker difficult because of its heavy dust content and the presence of too much metal, although there are some cities which enjoy a satisfactory demand. Dawes states further that "the promise of a substantial income from steam supplied to the electric department has not materialized in all cases," and that electrical engineers in charge of municipal electricity plants state that "the difficulties associated with joint plants often outweigh the advantages."

In England a process is used in which the entire refuse except metals is put through a hammermill crusher, the residue being used on farming land. It is said that the cost of grinding is about $1 per ton, to which must be added the transportation from the grinding plant to the farm. Grinding and subsequent use for agriculture is practiced also in Italy. In the latter country there appears to be considerable interest in agriculture, in the use of fermenting refuse, either with or without grinding, from the standpoint of warming otherwise cold, damp soil, as well as lightening the soil.

Disposal at sea in Europe is not generally looked upon with favor. In England and Wales only 6 towns continue to dispose of their refuse into the sea, although formerly more used this method. In Holland only one town continues this practice. The principal objections appear to be the return of floating refuse to shore, the inability to go to sea in stormy weather, with consequent nuisance at the dock, and the inability in calm weather to discharge refuse through hopper gates in the bottom of the vessel.

About one dozen towns in Italy use the Beccari process of fermentation. There are also in Italy several miscellaneous methods of disposal, such as the Lo Monaco method of sterilization and deodorizing with chlorine and subsequent use in agriculture, and the Grasselli and Boggiano-Pico methods of fermentation.

Another "Not Slippery When Wet"

Editor, Public Works Magazine.

Dear Sir:

I note the article by Samuel Eckels entitled "This Road Slippery When Wet," published in the November, 1935, issue of "Public Works"; also the follow-up article by Mr. Bernard E. Gray, entitled "Not 'Slippery When Wet'," in the December, 1935, issue. These articles are both well prepared and valuable, and demonstrate that these two engineers are awake to the importance of building highways with surfaces possessing a high degree of non-skid character.

While Mr. Eckels points out the non-skid character of a newly surface-treated road wherein tar is used as the bitumen, and Mr. Gray points out that of asphalt surfaces, I wish to call attention to the non-skid character of *sandstone rock asphalt.* A thin spread of this material placed upon any bituminous type of surface which is slippery will not only correct the slippery condition, but will also add to the durability of the road. Even where the location, grade, etc., are not desirable to be perpetuated, such treatment will make them safer and permit taking down the "Slippery When Wet" signs until a more satisfactory location is constructed.

Highway accidents can be materially reduced only by attacking the various and different contributing causes, and it would seem that we are justified in devoting some attention and some expense to each one of these. It has been announced that the government would spend several million dollars in carrying on a safety campaign to prevent highway accidents. No doubt the larger part of this expenditure will be incurred in educating the public in the importance of safe driving and the proper use of streets and highways by pedestrians. But the building of non-skid surfaces would be a very material contributing factor in the elimination of highway accident fatalities, and must not be overlooked.

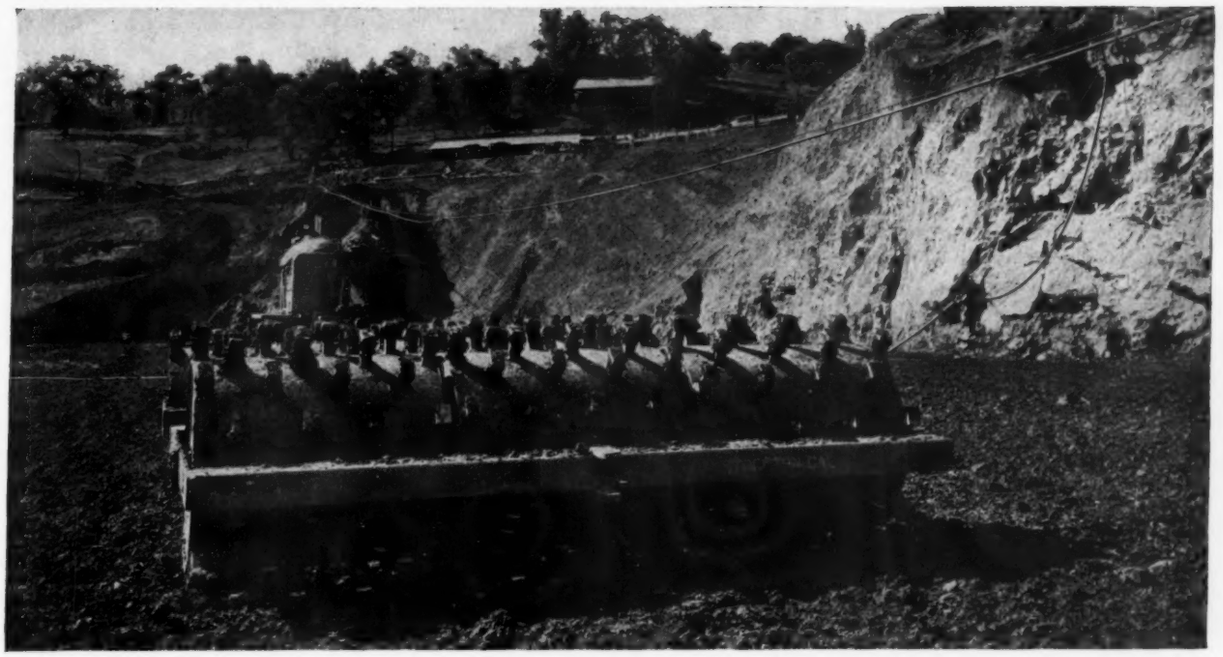
This is almost entirely within the hands of the highway engineer, and must be recognized as his responsibility. Engineers who offer as an apology for continuing to build slippery surfaces that we cannot eliminate from our street surfaces the snow and ice which produce a surface much more slippery than any road material, instead of looking for facts, are looking for an alibi. Records show that during the time road surfaces are coated with ice and snow, fatalities in highway accidents are reduced, and this is demonstrated in practially every snowstorm in the large city of Chicago. No doubt this is due to the fact that the streets at such times become so hazardous that people take extra precautions, and even though there may be accidents, they usually are of a minor nature and not often fatal.

Accidents from skidding result from the higher speeds on our road surfaces, and are most common at certain hazardous places such as curves, grades, and especially at intersections which require the autoist to make sudden stops. A careful study of the accidents on any highway system will usually demonstrate that the construction of the most non-skid type of surface at certain strategic points where these skidding accidents are most apt to take place, will very materially correct the difficulty.

It was shown by Professor R. A. Moyer, of Iowa State College, in the 1933 Proceedings of the Highway Research Board, that sandstone rock asphalt makes the most non-skid type of all the road surfaces, and it would seem that this material ought to be given consideration in the design of our highways. In addition, it has the characteristic of not being picked up by cars when it is freshly laid, as are some of the bituminous materials.

Very truly yours,

A. H. Hinkle, Director, Kentucky Rock Asphalt Institute



Le Tourneau sheep's foot roller on Coyote dam, Santa Clara Valley Water Conservation District. Two 3-section rollers behind a "50" tractor

Construction Procedure with Small Earth Dams

By W. A. Hardenbergh

DIVERSION of the stream to allow for the construction of the dam will usually be the first actual step in construction. A concrete dam is usually built in sections, and frequently these sections are carried up nearly to full height before the adjoining one is started; whereas an earth dam is built as a single structure, and should be carried up uniformly. Therefore diversion practice may vary; with concrete, diversion is possible by confining the stream to a portion of the channel while constructing complete, or nearly so, the remainder of the dam. In the case of an earth dam, a culvert or pipe must generally be so constructed that it will carry floods safely through the dam during construction.

The culvert or pipe may be intended to carry the stream flow during construction only, or it may be planned to act as a permanent outlet. In either case, precautions already outlined for structures passing through the dam must be followed. Of a recent dam, described in PUBLIC WORKS, C. A. Hogentogler, Jr., reports:

"During construction the stream flow was taken care of by a 36-inch metal pipe which was placed in a trench excavated to rock, and was bonded to the rock by a 6-inch concrete support, concrete also being poured between the sides of the trench and the pipe, and over the top of the pipe in an arch 6 inches thick. . . . To prevent the creeping of water along this outlet, several collars were added and very carefully selected material was hand-tamped around the pipe and collars."

These precautions are necessary with any pipe extending through the embankment. Pipes or culverts which are used only during construction should be filled with concrete when no longer needed for outlets.

An intake should be constructed several hundred feet above the dam, with a ditch to convey the water to the pipe or culvert outlet.

The capacity of the intake, ditch and outlet pipe needs careful consideration. Obviously these cannot be large enough to take care of all possible floods during construction. Balance probable flood damage to the work against the cost of providing these facilities and keep your fingers crossed. In an earth dam, overtopping of a partially finished job is nearly always disastrous, though properly balanced earth mixtures, such as discussed in the latest issue, when properly compacted, are very much less apt to suffer severe damage. For this reason, as well as for safety and satisfaction in service after completion, proper grading of the earth, control of moisture content, and thorough compaction are worth while.

Construction of the cutoff trench is next necessary. This should be carried down to rock, to an impervious stratum, or sufficiently deep to intercept any subsurface flow from the reservoir. If a concrete corewall is to be used, and the cutoff trench goes to rock, the rock should be thoroughly cleaned, examined for seams, crevices, faults, etc., grouted if necessary ,and the corewall tied firmly to the rock. If a corewall is to be used, but rock is not reached, excavation should be carried down to a thoroughly firm and tight formation, cores or drillings taken to assure a satisfactory depth of this stratum, and, in case of doubt, tight sheet piling driven down. This should be nearer the upper face of the corewall—preferably within a foot of it—and should be tied into the concrete.

Tight piling may also be used with a dam without a corewall, or with one having a puddle corewall; but

unless carried above the water level of the reservoir—in which case it becomes a thin and flexible corewall—it may be difficult to make a good tie between the sheeting and the earth fill and therefore it is a potential source of weakness. If used, and terminated below the water line, selected material should be carefully tamped around and over it.

Procedure in making a concrete core follows usual practice for making watertight concrete. The trench should preferably be filled with concrete: the wall should be carried up somewhat ahead of the earth fill, which should be very carefully compacted alongside of and against it. Fill should be carried up on both sides of the wall uniformly.

In making a puddle core, the trench should be wide enough so that spreading and compacting of material can follow the practice adopted for the body of the dam. The trench may be 18 or 20 feet wide, with edges sloping about 45°.

The area to be covered by the dam should be cleared of all trees and brush, sod and organic matter removed, stumps and roots larger than about an inch in diameter dug out, and in swampy spots or others which are not firm the unsatisfactory material should all be removed. The entire area should then be plowed; tractors and bulldozers are invaluable in this work. At some time before the filling of the reservoir, the shore line contour should be run and all trees and brush below this cut down and removed.

Spreading and Compacting

The soil of which the dam is to be made should be spread in layers 6 to 10 inches thick gauged by means of dump sticks or other devices. Bulldozers are extremely efficient in spreading the fill material in layers of uniform depth, and the tractor is a material help in compacting. Stones larger than 3 or 4 inches in size—the size of one's fist—should be excluded from the fill, and may be piled to form the downstream toe of the dam, as shown in Fig. 1 (see December, 1935 issue). Any excess of larger stone may be stored for riprap on the upstream face or for paving the spillway.

The soil should be tested for moisture content as it is placed on the dam; it should, of course, have been tested for texture, grading and other necessary characteristics previously. Moisture tests from time to time will determine whether the soil layers should be allowed to dry out before compaction, or whether sprinking is necessary to obtain the desired per cent of moisture. For adding water, a sprinking cart or a pump and hose may be used. Water should be applied to a compacted layer before spreading a new one, rather than to one not yet rolled.

Trucks hauling dirt and tractors operating bulldozers and other equipment aid in compaction. Road rollers, concrete rollers and other devices are also used for compaction. The sheepsfoot roller is superior to any of them. Multiple grooved rollers are preferable to smooth rollers, which tend to compact the fill in laminations, since with the smooth surface obtained by them, ties between the layers of fill are difficult to obtain, unless the surface is harrowed or dragged before the next layer of dirt is placed. This is not the case with the sheepsfoot roller.

Generally eight or ten trips of the roller and tractor are sufficient to produce the required compaction; a few days of experience will determine this for any particular job.

The faces of the dam should be built a foot or so beyond the limits shown on the plans, and afterwards trimmed to the proper lines, since compaction cannot be secured at the very edge of the bank.

Spillways have already been discussed. If possible they should be located away from the dam, in rock, or lined with reinforced concrete paving or with stone at least 12 inches deep and grouted with cement mortar.

Preventing Erosion of Earth Surfaces

Erosion of the face of a dam from heavy rains sometimes occurs. Prevention of this by means of a thin layer of bituminous material has been discussed and recent work in the highway engineering field is promising. Surface treatments on soil roads have been placed at costs around 1 cent a square foot. Bituminous stabilization (see PUBLIC WORKS, January, 1936) is being investigated, and highway fills in Virginia have been protected against erosion by one or more of these methods.

With a properly designed spillway, even an extraordinary flood, or the breaking of a dam upstream, should not cause overtopping of the entire length of a dam by more than a few inches. This being the case, protection against failure from this cause would be practically ensured by a light surface treatment or bituminous stabilization of the crest and downstream face, though this might have to be supplemented at the downstream toe, where conditions will be most severe.

A dam 40 feet high, with a downstream slope of 1:3 and a top width of 10 feet has about 135 square feet of surface area per running foot of full section of the dam. If the surfacing is placed on the entire downstream slope, over the top, and 20 feet down on the upstream side to prevent damage from wave wash, 155 square feet would be required per foot length of full section of the dam. If this surfacing should cost 3 cents a square foot (instead of the 1 cent at which some highway surfacings are being placed), the added cost would be only about $4.65 per lineal foot of dam. Since such a section contains around 175 cubic yards (with a 1:2½ upstream slope), such surface treatment would add less than 3 cents a cubic yard to the cost, and probably much less.

This method of protection is, as yet, we believe untried. The writer has discussed it with engineers and chemists of wide experience in the use of tars and asphalts, and will be glad to act as intermediary between these men and any engineers interested. The only expenses connected with such work would be those incident to making local tests with the actual materials used.

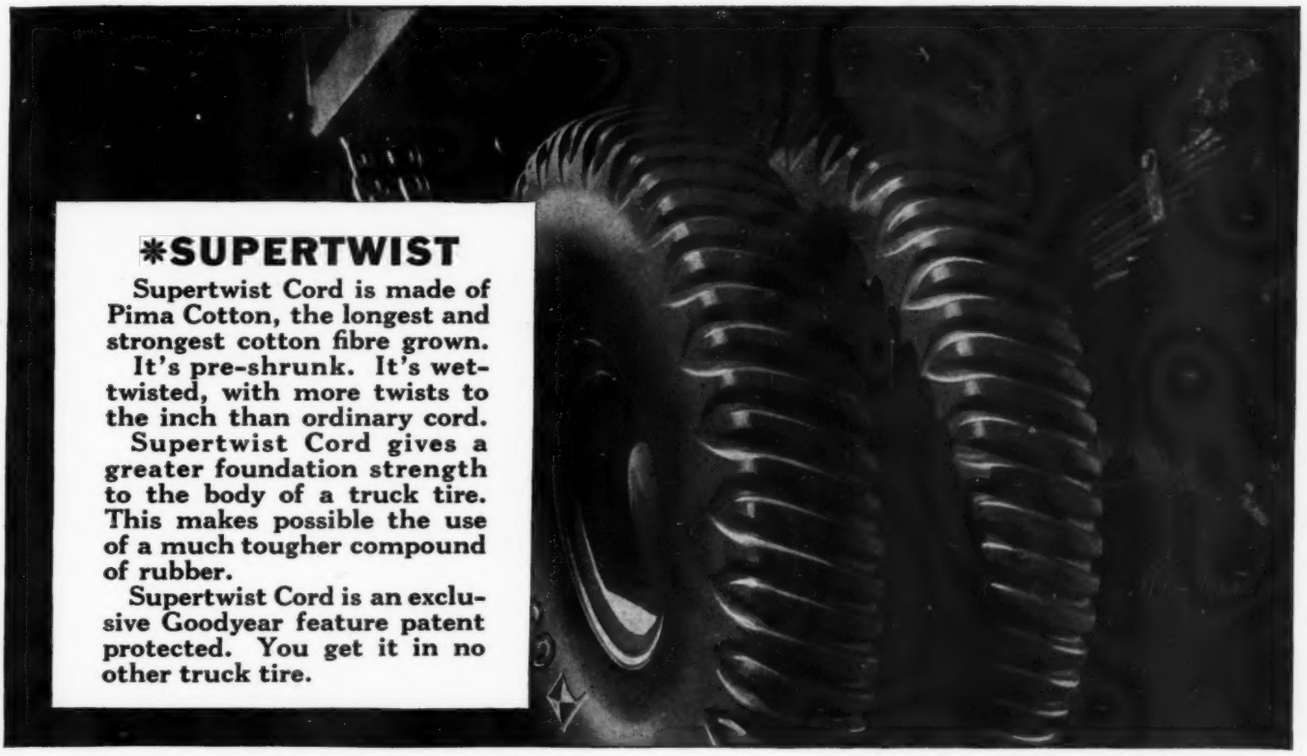
This is the final article on small earth dams. Comments are invited. Those that add to the general knowledge will be published.

Motor Vehicles in Refuse Collection in New York State

Of 38 cities in New York State covered by a recent survey of the Conference of Mayors and other Municipal Officials, 3 use horses exclusively for garbage and refuse collection; 35 cities, excluding New York City, employ 445 trucks on this work. Of 38 villages reporting, 5 use horses, but only one exclusively; this group of communities utilize 108 trucks for collection.

Trucks range from ½ to 7 tons, with the 2 and 5-ton units most popular with villages, and 3 and 5-ton units with the cities. Variations in type range from the open dump body to the modern enclosed vehicle. A few municipalities use trailers.

WHAT DOES SUPERTWIST* MEAN Under a Dump Truck?



***SUPERTWIST**

Supertwist Cord is made of Pima Cotton, the longest and strongest cotton fibre grown.

It's pre-shrunk. It's wet-twisted, with more twists to the inch than ordinary cord.

Supertwist Cord gives a greater foundation strength to the body of a truck tire. This makes possible the use of a much tougher compound of rubber.

Supertwist Cord is an exclusive Goodyear feature patent protected. You get it in no other truck tire.

DUMP TRUCK OPERATORS are enthusiastic about this new Goodyear Lug Type Balloon Tire. They like the way those heavy, diagonal tread bars grip, bite down and pull in rough, broken ground—in ruts—in sand—wherever their trucks go.

They like, too, that tough, durable body of Supertwist Cord. It gives them long tire life, dependable performance, more miles . . . lower cost per ton-mile hauling.

Try this New Goodyear on your dump trucks. You'll agree—it's a MONEY SAVER.

These are the reasons why you'll save money with your dump trucks on Goodyear Lug Type Balloons—

- **MAXIMUM TRACTION**—because of those heavy, self-cleaning lugs that bite down and hold.
- **EXTRA-STRONG BEAD CONSTRUCTION**—for heavy, swaying loads.
- **HIGH PROFILE TREAD SHAPE**—more rubber on ground, more pulling power.
- **GREATER BODY STRENGTH**—because of Supertwist cord.
- **HEAT-RESISTING RUBBER**—blow-out protection, longer wear.
- **PIMA COTTON**—longest cotton fibre grown.

Ask for more information about this new Goodyear Truck Tire that's built for the kind of work your trucks do.

THE GOODYEAR TIRE & RUBBER COMPANY, INC., AKRON, OHIO

GOODYEAR

LUG TYPE BALLOON

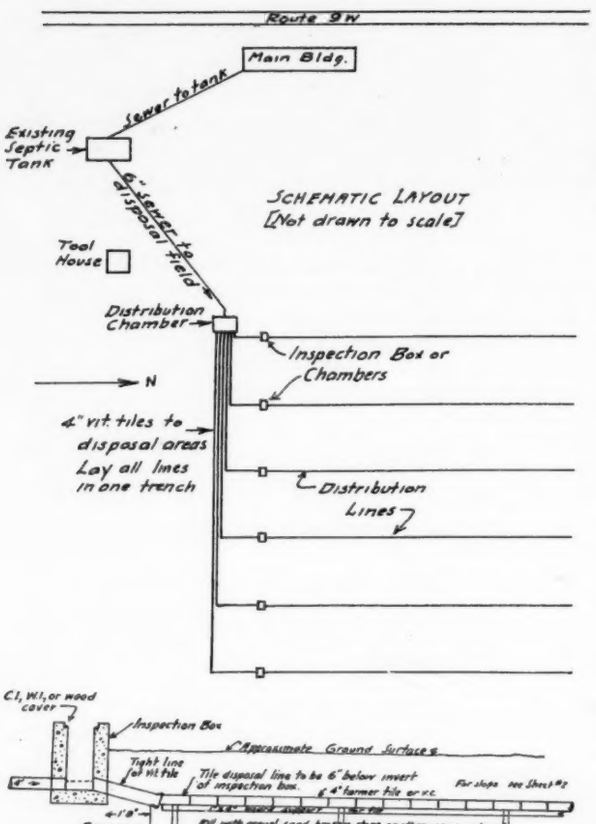
When you need special information—consult the *classified* READERS' SERVICE DEPT., pages 59-61

Sewage Disposal for Homes, Schools and Institutions

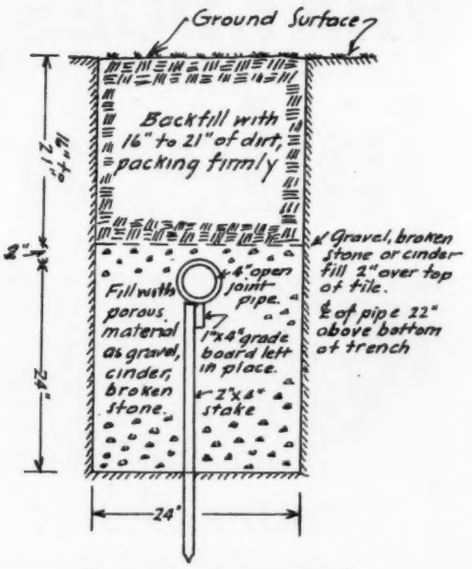
RURAL homes and schools, institutions and houses equipped with running water but beyond the reach of municipal sewer systems are confronted with a real problem in the sanitary and satisfactory disposal of sewage. The small septic tank has proven very satisfactory for the removal of the grosser solids; the real difficulty often lies in final disposal of the septic tank overflow.

The materials of construction of the small septic tank, and the capacity necessary, are matters of much difference of opinion. This writer believes that the requirements of most state boards of health are too high, being based to a large extent upon inefficient and home-made tanks. That is, the requirements are based on the poorest installation that is expected.

There seems to be no reason why a tank of 200 gallons capacity, properly constructed, will not serve the average family of 5 or even 6 persons very satisfactorily. During 1922 to 1926, some 4,000 such tanks were installed in and around Birmingham, Ala., and the percentage of failures has been extremely small during the more than ten years these tanks have been in service. Moreover, soil conditions are unfavorable in that area.


Route 9W
Main Bldg.
Sewer to tank
Existing Septic Tank
6" sewer to disposal field
SCHEMATIC LAYOUT
[Not drawn to scale]
Tool House
Distribution Chamber
Inspection Box or Chambers
N
4" vit. tiles to disposal areas
Lay all lines in one trench
Distribution Lines
C.I., W.I., or wood cover
Inspection Box
Approximate Ground Surface
Tight line of vit. tile
Tile disposal line to be 6" below invert of inspection box.
4" burner tile or r.c.
For slope see Sheet #2
Begin excavation here
Fill with gravel, sand, broken stone or other porous material (see sheet #2 and specifications)
3'-6" c.c. supports - 6'-0" o.c.

Above, general layout of plant and disposal field. Below, detail of seepage trench construction


Ground Surface
Backfill with 16" to 21" of dirt, packing firmly
14" to 21"
2"
24"
Gravel, broken stone or cinder fill 2" over top of tile.
4" open joint pipe.
Fill with porous material as gravel, cinder, broken stone.
1"x4" grade board left in place.
2"x4" stake
24"
C of pipe 22" above bottom of trench

Cross-section of seepage trench

For larger installations a capacity of 30 gallons per person should be enough for homes, basing the capacity on the upper limit of people to be served. Thus, if a home accommodates from 10 to 13 people, the lower limit should be 400 gallons. Modestly larger capacity will do no harm, of course. For schools, 15 to 20 gallons per pupil is sufficient. For manufacturing plants which do not discharge industrial waste, 20 to 25 gallons per employee is sufficient, using the larger allowances for the smaller plants. When data on actual water consumption are available, allow a detention period, on average flow, of 12 to 20 hours.

In this connection, toilet seats should be provided for about 8% of the number of employees.

Factors in satisfactory septic tank design, in addition to capacity, include depth, inlet and outlet design, shape, and depth and location of baffles.

The metal septic tank has proved to be very satisfactory in service, easy to install and low in first cost. Cement tanks are also available in the same sizes and styles, and are equally satisfactory in service. They may be cast locally, employing home labor, but are very heavy to handle. Built-in-place concrete septic tanks when properly designed and carefully constructed are equal in value to the other types, but too often are neither properly designed nor carefully constructed. Wooden septic tanks have recently been announced and should give good service. Fuller data on any of these types of tanks are available, on request, from the editor.

Disposal of the tank overflow is difficult, especially in tight soils. The illustrations herewith show a disposal field recently constructed to serve an institution using about 4,300 gallons of water per day, all of which was discharged into the septic tank. Noteworthy features are the small slope given to the tile lines; the filling of the trenches with cinder, thus allowing a greater area of soil into which the effluent could percolate; the use of a support for the tile line to maintain its grade; and the inspection boxes on each line.

For a single home, the same type of installation can be used. About 100 feet of tile line is sufficient for the

A Wealth of Experience Back of INTERNATIONAL HARVESTER POWER

An International Harvester T-40 TracTracTor pulling an 8-ton concrete roller on top of the East Barre rolled-earth dam near Waterbury, Vt. This is one of the new flood-control dams being built across the Winooski river. Four TracTracTors were used on this dam.

●

The International Harvester line of industrial power (gasoline and Diesel) includes TracTracTors, wheel-type tractors, stationary power units from 12 h. p. to 100 h. p., and 1½ to 5 h. p. engines for light-duty service.

INTERNATIONAL HARVESTER Industrial Power—product of the world's largest tractor builder—reflects the valuable experience this organization has gained through its long and close association with you engineers, contractors, road builders, public officials, and other users of heavy-duty power.

Take the TracTracTor for example. In designing this tractor, International Harvester put onto the market the *most accessible, most easily serviced* crawler. Steering clutches and brakes can be inspected, adjusted, or replaced through rear cover plates without disturbing the tracks, track frames, or driving sprockets. And working parts are thoroughly protected against entrance of abrasive materials by the effective use of self-adjusting triple dust seals.

Your best investment in industrial power is International Harvester. The nearest industrial dealer or company-owned branch is ready to serve you well.

See them about a demonstration.

INTERNATIONAL HARVESTER COMPANY
(Incorporated)
606 So. Michigan Ave. Chicago, Illinois

INTERNATIONAL HARVESTER

When you need special information—consult the *classified* READERS' SERVICE DEPT., pages 59-61

average home even in tight soil, and the trench may be materially smaller than that shown herewith. If made of sufficient size to require 5 yards of cinder or gravel filler, satisfactory results will be obtained. Attention should be paid to maintaining a small but uniform grade in the disposal line.

Most of what has been said refers to tight soils where cesspools are not satisfactory for any considerable length of time. In sandy or gravelly soils, the problem is not a difficult one.

In tight soils, it is necessary to provide at least one square foot of soil surface into which the effluent can soak for every gallon per day of sewage discharge. Thus, the trench shown herewith which has an area of 6 square feet (2′ on the bottom and 2′ on each side) per running foot of trench length, will satisfactorily handle 6 gallons per day of effluent per foot length of trench.

The general recommendations herein are based on a considerable experience in this work. They do not comply with the requirements of some state boards of health. Before doing any work along this line, the regulations and suggestions of your own state board of health should be studied and the works constructed in compliance with them.

Toledo to Generate Power From Sewage Gas

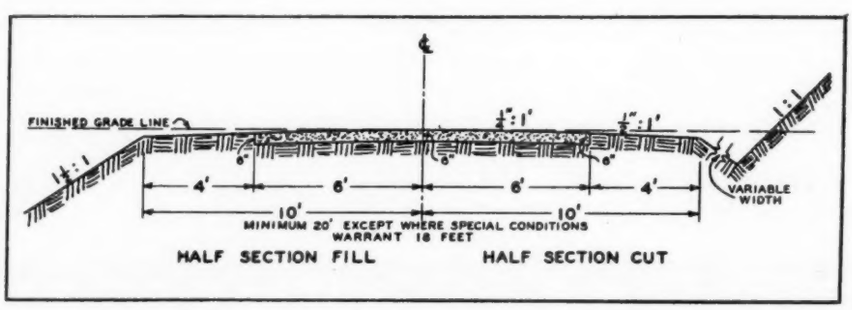
Power for the operation of the Toledo sewage disposal plant will be produced by the conversion of gas from sewage wastes, according to City Manager Edy. The conversion of gas into electric power will be made possible by the installation of a $36,000 power unit. It is estimated that the power savings alone will more than pay the cost of the equipment. As a by-product of sewage treatment the Toledo disposal plant is also engaged in fertilizer production on a small scale.

Conditioning Rural Roads in Virginia

All county roads have been taken over by the state in Virginia, and the Department of Highways is responsible for nearly 39,000 miles of rural roads. Herewith is shown a typical section proposed for WPSO projects. This work, which is called "conditioning," consists of widening; surfacing with local materials, such as gray soil or gravel; putting in pipe drains; constructing ditches and shoulders; and bringing the road to a proper section.

Later on many of these roads will be bituminous surface treated. Such treatment has been given on both gravel and soil surfaces, and when properly drained, these roads have given excellent service at low maintenance costs.

Most of the above information was supplied to us by A. H. Bell, Assistant Engineer of Surveys and Plans, Virginia Department of Highways.



Standard typical section for WPSO projects, Virginia Dept. of Highways

Tractor excavator under railroad track

Tractor Saves Money in Under-Track Excavation

The versatility of tractors in performing unusual jobs at very considerable savings in operating costs was recently evidenced by the Cornell Contracting Corporation in special excavation work on a sewer contract in Buffalo. The excavation was being done mainly by clamshell and crane, but where the sewer was to pass under the Erie Railroad tracks it was impossible to work the clamshell. The problem of excavating the sticky clay under these tracks was solved by lowering with the crane of the clamshell the tractor equipped with 6-foot bulldozer and then working the wet clay in the close quarters prevailing out to where it could be picked up by the clamshell. The extra cost of doing this work under the tracks by wheelbarrow and shovel would have been around $1,500. The tractor used was a TA-40-TracTractor.

Twenty-Two-Million Acre Watershed Survey

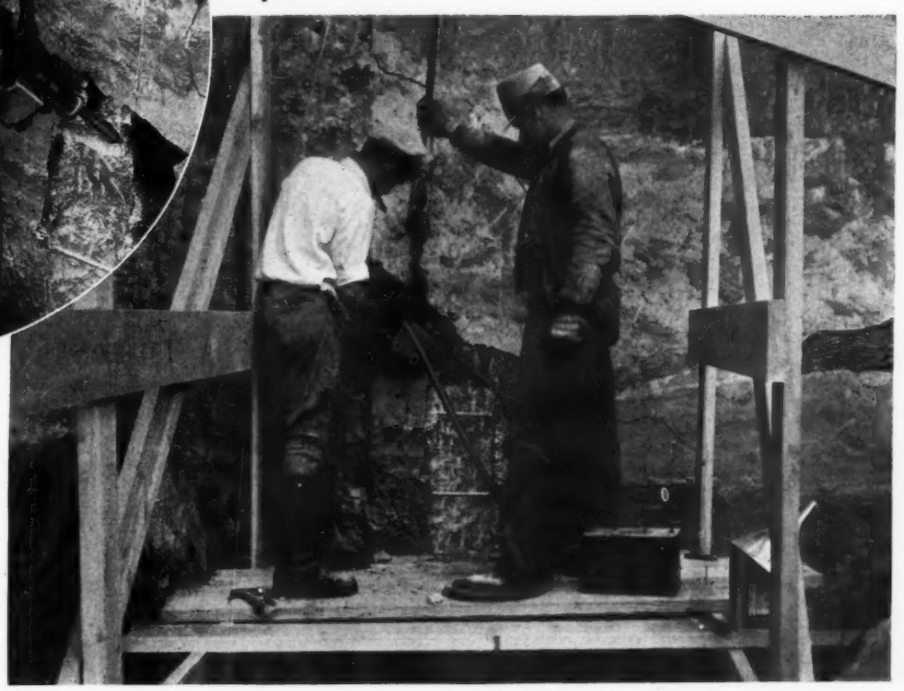
In July last, the Soil Conservation Service contracted with Fairchild Aerial Surveys for an aerial survey of the 22,000,000-acre area in the watershed of the Rio Grande of central New Mexico—the largest aerial survey ever attempted in this country. The contract called also for radial triangulation ground control, by which to tie together the individual photographs into a complete map accurate in scale.

Ground survey work is expensive and slow, and the number of control points is reduced to the minimum that will give an accurate composite map. In this case the number of such points to be established was only 46, but would have been 360 if it had not been for the "Tandem 10-lens" camera, specifically developed by the company to facilitate this survey. This made possible the photographing, in each flight, of a strip of country 11 to 15 miles wide, with an interval of 5 miles between exposures instead of the customary 1 mile.

This tandem camera was used only for securing control strips, at an average altitude of 24,000 feet, about 400 such photographs being taken. The actual mapping, however, was done with a smaller camera, taking some 9,000 photographs.

The flying was completed by December 1, but a survey party of three men remained for several weeks longer in the field establishing a few more control points—frequently on snowshoes although in one of our southern states.

Jobs Like This.. *No Problem* WITH A BARCO PORTABLE GASOLINE HAMMER



General contractors on this building—U. S. Fireproofing Company.

Constructing an extension to the Denver United States Custom House building required that a channel 10" x 6" be cut on the present stone and concrete foundation. A Barco J-1 Portable Gasoline Hammer was used to do this work, operating most of the time in a nearly horizontal position.

This is merely one of the many types of hammer jobs on which the Barco has demonstrated its ability and economy. Rock breaking, sheeting driving, back-fill tamping, concrete breaking, drilling, digging frozen ground—any or all in the course of a day's work. It can be used efficiently and economically anywhere the operator has room to work.

Model H-5 for heavy duty, weight 89 pounds; J-1 for lighter work, weight 70 pounds.

BARCO MANUFACTURING COMPANY
1807 Winnemac Avenue, Chicago, Illinois

A Digest of the Sewerage Literature of the Month giving the main features of all the important articles published

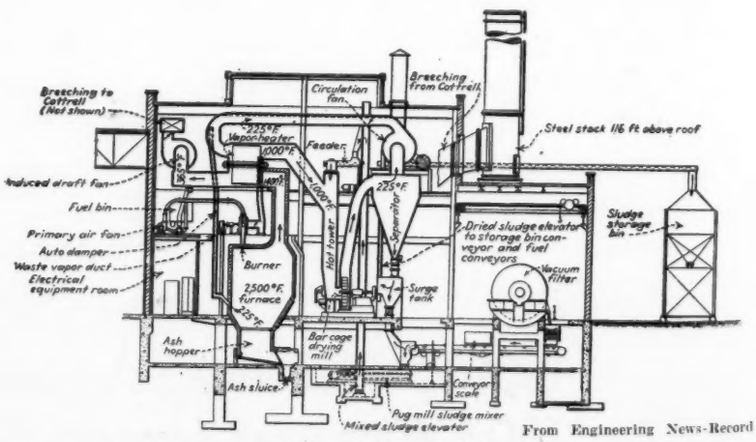
The Digestion Tank

RESERVOIR micro-organisms in the Scituate reservoir (Providence, R. I.) have occasionally numbered ten times as many on the surface as near the bottom and averaged twice as many. Water is drawn at a depth of 60 ft., 20 ft. from the bottom, to avoid these; and although counts of Cyanophyceae as high as 60,000 have been obtained, no treatment of the water has been necesary because none are withdrawn at that depth. Other advantages of the deep intake are the lower temperature of the water and the natural coagulants in solution in this lower stratum.[B2-9]

Cleveland's treatment facilities are being increased by construction of a 123 mgd. activated sludge plant in the Easterly district to supplant a coarse screening and chlorination unit. Among the original features are the grease separator—a series of horizontal baffled around-the-end flow type of tanks equipped with diffuser plates through which air is bubbled; and the pumping of primary and excess activated sludge of 97% moisture content for a distance of 13 miles, overcoming a total elevation of 225 ft., to the Southerly plant, where it will be preconcentrated in Dortmund-shaped settling tanks giving one hour's detention and compacting to 96% moisture before going to digestion tanks, which are hexagonal in shape, 6 of them surrounding a hexagonal-shaped control chamber.[E2-3] (A plan of the Easterly plant was shown in the February issue but was mistakenly captioned "General lay-out of Columbus plant." This illustration and descriptions of both the Cleveland and Columbus plants appeared in the same issue of *Engineering News-Record*.)

Sludge incineration is part of the treatment at the new Calumet (Chicago) sewage treatment plant which was placed in operation Dec. 3, 1935, to handle the sewage of 300,000 present and 390,000 future tributary population. Suspended solids are estimated at 110 lb. per capita per year, of which 90% will be removed, or 53 tons a day to be disposed of, or 2,650 tons of 98% moisture sludge. The settled activated sludge, that from the preliminary tank and pulped screenings are mixed and thickened in tanks; dosed with 4% to 6% of ferric chloride, proportioned by dry weight (dosage controlled by venturi meter in sludge line and orifice meter in ferric chloride line, connected through electric automatic flow ratio controller); agitated for 10 min. by wooden paddles revolving around a horizontal shaft in a steel tank with a paddle-tip speed of 63 ft. per min. The conditioned sludge then goes to three rotary vacuum filters, each with 570 sq. ft. effective filter area, estimated to dewater 3 lbs of dry solids per sq. ft. per hr. (it is expected that this rate will be exceeded). The filter cake, 80% moisture, is mixed in a pug mill with previously dried sludge to give 40% to 50% moisture so that it will not pack into a doughy mass; passes through screw feeders which tear it apart; passes through towers mixed with vapor heated to 1,000° F; thence through a rotating cage consisting of three concentric cylindrical rows of bars which revolve around a horizontal shaft, meshed with a stationary cage of two concentric cylindrical rows of bars, which break the sludge into small pieces; after which it is collected in the bottoms of cone-shaped separators as a powder with about 10% moisture, and incinerated in three flash-type furnaces using high-velocity, vertical, powdered-coal burners. The gases from the furnace are used to heat the vapor and pass through a dust precipitator, travelling between high-potential electrodes, on which 95% of the dust collects and is shaken off into hoppers below. All vapors pass through the furnace before escape into the atmosphere.[E3-1]

The two-tier activated sludge plant at Barking for treating 10 mgd. of the sewage of London, England, has proved so satisfactory that a larger plant for treating 50 mgd. additional is now under construction differing from the present one only in relatively small points. The chief interesting feature of the plant is the constructing of the aerating channels, of which there are 33, each in two tiers, giving a total length of 6,400 ft. The sewage passes, alternately through an upper and lower compartment, through the whole 66, circulation being effected by means of paddles at each end of each channel. From 0.5 to 0.6 cu. ft. of air is used per gallon, most of it for reaerating the sludge, part of which is added to the sewage as it enters the aerating channels. Only 45 ppm. of suspended solids



From Engineering News-Record

Equipment for dewatering, drying and burning sludge at the Calumet plant, Chicago.

Above: Nichols Herreshoff Sewage Sludge Incinerator installation at the West Side Disposal Plant at Dearborn, Michigan. *Left:* Open Hearth of Incinerator in action.

BURNING IS THE ONLY METHOD OF *COMPLETE* SEWAGE SLUDGE *DISPOSAL*

The burning of sewage sludge, as accomplished by the Nichols Herreshoff Incinerator, destroys bacteria and organic matter, leaving as a residue a fine, clean, inert ash.

The introduction of this equipment marks a significant phase in municipal sanitation, and assures a thoroughly satisfactory and economical method of *complete* disposal.

It makes the unsanitary, unsightly and malodorous sludge pile a thing of the past.

Back of this equipment is more than fifty years of intensive experience in the chemical, metallurgical and other fields—a reputable organization equipped with an experienced engineering staff ready to assist you in solving municipal waste disposal problems.

NICHOLS HERRESHOFF SEWAGE SLUDGE INCINERATOR

NICHOLS ENGINEERING & RESEARCH CORP.
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are wasted with the surplus sludge (which is discharged into the sedimentation tanks) because of "the effective reaeration, which has caused much of the organic matter removed from the liquid during what Theriault calls the 'clarification stage' to be oxidized and lost to the air as carbon dioxide." Disposal of the sludge at sea is satisfactory and inexpensive, but digestion of part of it is to be tried as "the means both by reducing the amount sent to sea and of converting part of the organic matter into useful gaseous fuel."[D3-1]

Sewer rentals are charged by cities in 32 States, 24 of which have State enabling acts, while the other 8 have special charter provisions or interpret the general law as permitting it. Eight other States have passed enabling laws but none of their cities have yet taken advantage of them; one of these, Nevada, having had such law since 1919.[J2-2]

Chlorinated copperas precipitation is not aided by presedimentation, and it is indicated that chemical treatment of settled sewage would be more costly and less satisfactory than of raw sewage.[L1-1]

Trickling filter operation is improved by small doses of copperas (but only when accompanied with chlorine oxidation), which apparently make the colloidal matter more amenable to filter treatment, and iron on the filter stone seems to produce better purification.[L1-1]

Cement pipe to resist corrosive action of aqueous solutions of carbonic and other acids that may occur in soils and sewage have been studied by Danish engineers. They concluded that water curing insured tight pipes, but was unnecessary if sufficient mixing water was used; and that a 1:1.5 cement and sand mix was no better than 1:2. Pipe of the latter mix with 8 to 10% water content withstood a continuous flow of acid water under a 6.6 ft. head for 3½ years with only an erosion of 0.7 mm depth on thin inner surface; the acid used being free carbonic, aggressive carbonic and bicarbonate carbonic. Coatings of thin tar, applied either hot or cold, were quickly destroyed. But pipes of 1:5 mix dipped in hot viscous tar or asphalt were acid-resistant but blistered in time. Dipping in water glass did not increase acid resistance. Soap in the mixing water improved water tightness and acid resistance but caused 33% loss in strength.[E1-4]

A triple sewer system is used in Paarl, South Africa, one system for storm water, a second for domestic sewage and the third for trade wastes. A large part of the factory wastes consists of strong spent wine, a very small part of which mixed with domestic sewage increases greatly the difficulty of purifying it. The wastes are given 5 hours' detention in a mechanically cleaned clarifier, and the 300,000 gpd of effluent is turned onto 4 acres of porous ground, divided into 10 beds used in rotation, and the sludge is dried on sand beds. The domestic sewage is given activated sludge treatment and the effluent is further treated on sprinkling filters and chlorinated and then used for irrigation.[E1-2]

Sanitary services after floods which should be rendered by health authorities include: Organization and supervision over water delivery services where failure of supply has occurred. Checking "boil water" warnings in public eating places. Dispose of dead animals. Supervise temporary eating places. Distribute chloride of lime for disinfecting premises. Pump and clean out flooded houses and basements. Disinfect basements, using portable and truck-mounted equipment. Dispose of refuse and decomposing matter from basements. Sanitary surveys in small hamlets and rural sections, reporting illness and relief needs. Lime and oil exposed mud flats. Use oil and calcium chloride on streets to control dust. Reconstruct and build privies. Drain impounded waters. Take people to typhoid immunization clinics. Sanitation of railroad labor camps. Investigate nuisance complaints. Restore sewers and treatment plants to normal operation. Supervise existing and emergency pumps and incinerators. Limited mosquito control measures. After floods in New York State in 1935, more than 5,000 men were employed in such work under the State Board of Health.[A2-1]

Bibliography of Sewerage Literature

To find an indicated reference, find the given letter and bold-face number at the left of the column, and the light-face number (following the dash) immediately below this. The bold-face number indicates the month of issue of Public Works in which the article was listed, which is generally the current but may be a previous one.

c, Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or abstract); *t*, technical article.

C 3 *Sewage Works Journal*
January
1. Digestion of Garbage with Sewage Sludge. By. D. E. Bloodgood, pp. 3-12.
2. Experiments on the Digestion of Garbage and Sewage Solids. By F. H. Whitley, Jr., pp. 13-15.
3. The Dosing of Sewage Tanks with Ground Garbage. By H. E. Babbitt, pp. 16-21.
4. Diffuser Plate Studies. By A. J. Beck, pp. 22-37.
5. Use of "Cloroben" in Sewage Treatment. By W. Rudolfs and L. R. Setter, pp. 38-56.
6. Operation of Sludge Gas Engines. By S. A. Greeley and C. R. Velzy, pp. 57-63.
7. Operation of a 200-Horsepower Gas Engine Using Sludge gas for Fuel. By C. F. Tennant, pp. 64-67.
8. The Palo Alto Sewage Treatment Plant. By H. O. Banks, pp. 68-80.
9. Generation of Electricity at Palo Alto with a Gas Engine. By H. O. Banks, pp. 80-84.
10. Minneapolis-St. Paul Sewage Disposal Project. By G. J. Schroepfer, pp. 85-93.
11. Magnetite Filters in Sewage Treatment. By S. I. Zack, pp. 94-109.
12. Sewage Disposal Practice in Canada. By A. E. Berry, pp. 110-116.
13. Chemical Treatment of Sewage at Two Western Plants. By F. M. Veatch, pp. 117-121.
14. Treatment of Industrial Wastes in Connection with Domestic Sewage, By L. F. Warrick and E. J. Beatty, pp. 122-132.

D 3 *The Surveyor*
January 17
1. *p.* Recent Developments in Sewage Treatment and Disposal at the London County Council Works. By J. H. Coste, pp. 75-77.

January 24
2. *t.* The Design of Surface Water Drains. By A. S. Turner, p. 101.
3. *p.* Outlines of Practice in Sewage Disposal. By K. B. Robinson, pp. 105-107.
4. *p.* Some Recent Developments in Sewage Purification. By J. H. Garner, pp. 109-111.
5. Sewage Treatment Trends in England. By Karl Imhoff, pp. 113-114.

January 31
6. Sewerage and Sewage Disposal in 1935, pp. 138-150.

February 7
7. *p.* The Approach to Sewage Chlorination Problems. By C. Lea, pp. 255-256.

E 3 *Engineering News-Record*
January 23
1. Sewage Sludge Incinerator at Calumet. By W. A. Dundas, pp. 116-119.

January 30
2. Milwaukee Extends Facilities for Sewage Treatment. By D. W. Townsend, pp. 153-157.

February 13
3. Coal-Mat Filters and Centrifuges at Niagara Falls Sewage Plant, p. 245.

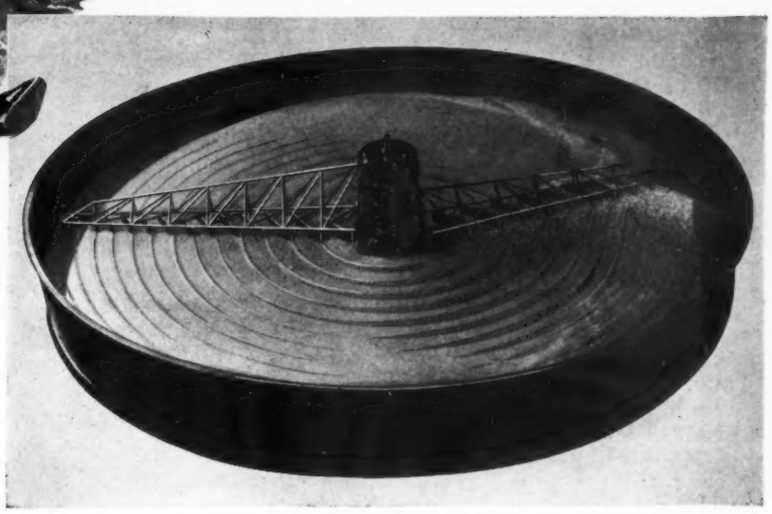
H 3 *Municipal Sanitation*
February
1. Recent Trends in Sewerage and Sewage Treatment. By C. G. Hyde, pp. 44-51-58.
2. Bulking of Activated Sludge. By W. A. Larsen, pp. 52-54-64.

K 3 *Proceedings, Am. Soc. of Civil Engineers*
February
1. Sedimentation in Quiescent and Turbulent Basins. By T. R. Camp, pp. 281-290.

P 3 *Public Works*
February
1. Operating Small Sewage Treatment Plants in Southern States. By C. C. Brown, pp. 13-14.
2. Utilization and Treatment by Industrial Wastes, p. 14.
3. Economics of Sludge Disposal Methods, p. 24.
4. Lubrication of Sewage Treatment Equipment, pp. 25-26.

R 3 *Contractors & Engineers Monthly*
February
1. *c.* A 54-Inch R. C. Sewer Built in Columbus, pp. 1-17.

High-Stepping Overloads WITH THE DORR TORQ CLARIFIER



Dorr Torq Clarifiers in Operation:
Grand Coulee Dam, Washington.
3—125 ft. dia.
Golden Queen Mining Co., Mojave, Calif.
4—55 ft. dia.

Dorr Torq Clarifiers on Order:
All-American Canal Desilting Plant, near Yuma, Ariz.
72—125 ft. dia.

THE new Dorr Torq Clarifier steps smoothly over overloads—simply, effortlessly, automatically. It doesn't attempt to plough through them—bringing unnecessary strains into play and calling for manual manipulation of the rake lifting device.

The Dorr Torq Clarifier does just what you do when you meet an obstruction in your path—just what a well-sprung, modern car does when it strikes a bumpy road.

But as the arms swing upwards from the center, they continue to rake at full capacity. Thus the overload is raked down further and further at each revolution until the rakes resume their normal operating positions.

The "torque-type" overload relief is obtainable only with Dorr sedimentation units. It protects you against the breakages, due to overloads, which occasionally occur in the best regulated plants.

Plan now to investigate further the Dorr Torq Clarifier by writing to our nearest office for details.

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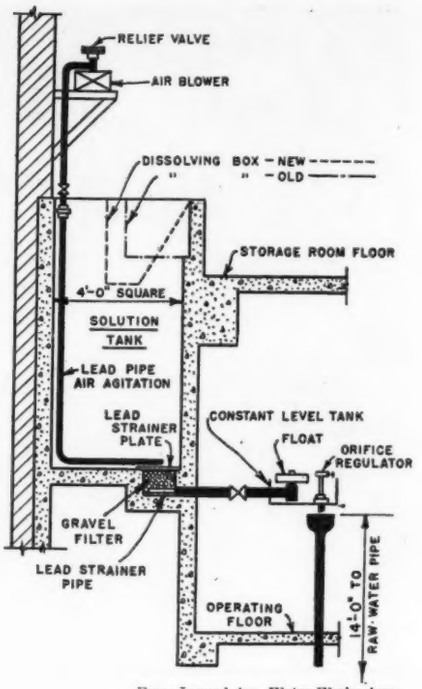
Following is a digest of the important articles published last month having to do with water works design, construction and operation and water purification, arranged in easy reference form.

The Water Wheel



Cross-section of alum solution feed equipment at Winnetka

From Journal Am. Water Works Assn.

TWO-STORY settling basins have been adopted for Milwaukee's new purification plant, because the water level in the basins came 30 feet above the ground (lake bottom) where they were to be built, a 30-ft. depth of basin was not considered desirable, and the two-story construction would be $200,000 to $325,000 cheaper than supporting a shallower tank on piles and confined sand fill. Experiment with two-compartment basins on Great Lake supplies indicates that in a two-story basin the heavy sludge would all be deposited in the lower story and only light sediment (mostly floc) would reach the upper. Other advantages are that double the settling capacity can be provided on a given area; solid lake bottom affords a more reliable support than piling and fill; the water leaves the upper story at the same end at which it enters, economizing in conduits; and the two-story basin more effectively distributes the water over the cross-section than is practicable in a deeper basin of the same bottom. The intermediate floor and roof are supported on concrete columns; holes in the former serving to equalize the pressure above and below it, and permit the floc in the upper basin to drain through to the lower.[G2-1]

Floc formation in a filter plant varies with the details of preparing the alum solution. Studies in the Winnetka, Ill., plant indicated that an important feature is agitation in both dissolving box and solution tank; continuous mechanical agitation is the most effective method for dissolving ground alum in the dissolving box; position and speed of paddle are important features for keeping the alum in good suspension; a cylindrical shape dissolving tank gives best results for dissolving with mechanical action; prolonged high-speed mechanical agitation of the alum solution in the preparation stage has no preventive or retarding effect on the formation of floc; strength of solution, when prepared by high-speed mechanical agitation, is not a controlling factor in floc formation. For preparation of solution by the dry feed method, with mechanical agitation, the important features of the dissolving tank are paddle size, paddle speed, tank capacity and water supply control for the variable water temperatures; the tank should have a capacity of at least 5 minutes detention period, solution strength governed by tank construction, a meter for the water supply line, and a peripheral paddle speed of at least 200 fpm with paddle length 50% of tank diameter and paddle surface area of 1 sq. ft. for each 5 to 15 cu. ft. tank capacity, with tank diameter same as water depth.[A2-21]

Taste and odor correction can be effected in a number of ways. "Permanganate of potash can be used for the reduction of certain tastes associated with micro-organisms, faint chlorophenolic tastes and odors and certain industrial wastes including naphtha and resin soap wastes. In conjunction with activated carbon it can be used effectively against lacquer solvent wastes. Ammonia-chlorine is effective in many tastes and odors caused by micro-organisms and chlorophenolic tastes and odors not accompanied by high organic matter or other trade wastes. It will effectively mask high chlorine residuals in treated water. Super- and dechlorination will destroy tastes from some micro-organisms and tastes and odors associated with coaltar byproducts and certain oily wastes. In some cases the joint use of activated carbon is necessary. In all cases the correct dosage of chlorine must be applied and adequate contact period given. The question of dechlorination must also be considered. Of all methods of treatment employed it is the most difficult to control. . . . It is imperative that, regardless of taste, an adequate dose of chlorine be maintained to insure the safety of the supply. Activated carbon used alone or in conjunction with other processes is the most flexible and possibly more effective than any other reagent. It can be used in conjunction with prechlorination, superchlorination, split chlorination and chloramine treatment. Ozone is effective in moderate chlorophenolic tastes and odors and certain tastes associated with decomposing organic matter.[Y3-2]

Remote control of electrically operated pumping stations is best accomplished with supervisory control over great distances and direct wire over short distances. "Visible" supervisory control, even at higher initial cost, is preferred over the "audible" system involving sending out dots, dashes, buzzer tones and gongs. The visible method shows operating conditions by lights and buttons continuously at a glance. The new Saline station in Pittsburgh is provided with visible control for continuous operation to maintain adequate pressure in certain high areas difficult to supply before the installation of this station. Supervisory control for this station has paid for itself in less than a

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year by reduction of operating personnel and maintained more exact and uniform control of main pressures and available water in high pressure storage. Savings have been effected also by this exact operation. Stations are automatically controlled to maintain water elevation in reservoirs or pressures in the system between definite limits using diaphragm operated mercury switches sensitive to a change of 6 inches in pressure, but will not operate due to thermal relays until pressure has remained at a lower level for 2 minutes. Such action prevents starting of pumps due to momentary heavy draft. Possibilities of remote control and central station control offer a variety of application not yet fully realized.[F2-4]

In making collections, the Western New York Water Co. gives no discount for prompt payment, but for its customers' convenience it maintains neighborhood collectors (it supplies Buffalo and 16 surrounding villages and towns) who accept money up to the due date but no later, and after this the consumer must travel some distance in to the main office in Buffalo or else spend extra money for postage and money orders (very few of them have checking accounts). As a result, the majority of the bills are paid before the due date.[A2-15]

C. I. pipe coating applied 50 years ago has been found bright and clean, but in recent years "the tar has been distilled until there is little left but the black" and "we may expect the near future to see the coaltar industry cheerfully offer a pitch that is colorless, odorless, tasteless—and valueless." Experience with cement lining, while brief, has on the whole been very satisfactory.

Pipe failure may be caused by laying pipe on blocks, causing beam action. But "the largest single cause of pipe failure is due to traffic vibration" due chiefly to "the terrific impact load of 7 to 10-ton trucks and buses traveling at relatively high speeds." Laying pipe under sidewalks is a less reliable remedy than laying them deeper.[Y3-1]

Earth fill dam designing must take into account perviousness of foundation material as well as of dam; also slope of up-stream face should not permit sloughing of embankment if water in reservoir is rapidly drawn off. If base width of dam at any point below the water surface does not give sufficiently long path of percolation though the foundation soil to prevent undue seeping through it, this length can be increased by widening the base of the dam, or by laying a blanket of impervious material on it back to the desired point. The latter is generally the cheaper. Also the base should be sufficiently wide to prevent the foundation squeezing out from under the dam when percolation through it is taking place, which may necessitate widening the base. A cut-off wall is of little use unless it is extended into some formation more impervious than that on which the dam rests; unless it serves to anchor a concrete face slab. Such a slab prevents erosive action on the dam, but gives practically no water-tightness as the percolation rate through the slab is much greater than that through the earth fill.[A2-26]

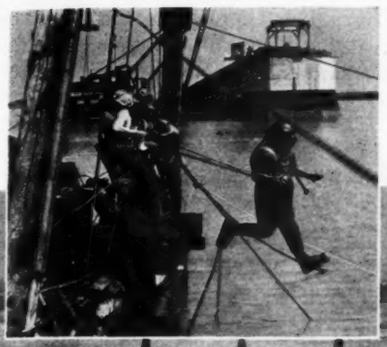
Fire service charges in New England cities vary from 49 cts. to $1.08 per capita per year, or equivalent to a hydrant rental of from $4 to $133 a year, averaging $37. Of 131 municipally owned plants, 84 receive no revenue for fire service; and of 46 privately owned plants, 3 receive no revenue. The revenue received for fire protection ranges from 10 to 18%, average 15%, of the gross revenue by private plants; and from 7 to 20%, average 12%, by municipal plants. Wisconsin is the only State, to the writer's knowledge, which has established rates which adequately compensate for the calculated costs of public fire protection.[B2-1]

Underground pressure tanks were installed to give adequate pressure to the residential village of Plandome, N. Y. This method was adopted to eliminate the construction of an elevated tank or tower because of its unsightliness in such a village. Supply is obtained from two deep developed wells which pump directly into the distribution system, the excess going to a battery of ten hydro-pneumatic tanks of 150,000 gallons total capacity. Tanks are located in the highest section of the village and provide sufficient gravity flow for the fire protection of the populous section. Adequate pressure for the higher section is provided by supplementing the gravity head by air compression in the tanks. No part of the storage tank gallery stands more than eight feet above the ground. Rates have been reduced to 35 cents per 1,000 gallons as against 50 cents per 1,000 gallons when purchased from the neighboring water district. The completed system, including reinforcing of the distribution system and the development of the two wells, was done at a cost of $54,724 and was financed through the PWA.[F2-1]

Welded steel pipe *27"* diam. and 23 miles long delivers filtered water to Fort Smith, Ark. Delivered in 40′ lengths, jointed by Dresser couplings, and by welding in places. At the nine creek crossings and in river valleys the entire line of pipe is welded into one length with a long expansion sleeve at each end. Under creeks the pipe is placed in a rock trench which is backfilled with concrete. To permit temperature movements, the pipe is wrapped with 35 lb. rag-felt coaltar-saturated pipe-line felt, applied spirally and sealed at laps with a hot solution, but not bonded to the pipe, the inside of the wrapping being coated with mica. The pipe is lined with hot bituminous enamel spun on, and the outside is covered with the same enamel. At a draw bridge the pipe, which is suspended under it, is arranged so it can be uncoupled at the ends of the draw span (the river here is only theoretically navigable), long-sleeve couplings being placed here and permanent working platforms suspended under them. In passing under a railroad, a *32"* steel culvert was jacked through and the pipe pulled through it.[E3-4]

Electric pumping compares favorably in cost with the most efficient steam pumping machinery; electric stations are small, clean and neat and can be located in residential districts, require a small personnel and little attention, and lend themselves to automatic or remote control. For power unit, the squirrel-cage induction motor is the most popular because of simplicity of construction and adaptability to widely varying duties, availability in any desired rating, strength and rigidity and low weight per horsepower.

Synchronous motors are ideal for pumping, especially when maintained always at the rate for which they are designed, thus giving high efficiency; and secure low rates for current where the power company allows credit for high power factor operation. In general, 95% of municipal pump service can be covered by a single-stage, double-suction, split casing pump, with either a squirrel-cage or synchronous motor. Squirrel-cage



Sections of coated and lined pipe were welded into 120-foot sections . . . around which were cast eight inches of reinforced concrete . . . placed on the bottom of San Francisco Bay. Courtesy Western Pipe and Steel Corporation, Pacific Bridge Company, City and County of San Francisco Public Utilities Commission, San Francisco Water Department.

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motors are universal below 50 hp., generally 220 or 440 volt, but above 40 hp. 2200 volt motors are obtainable. Above 50 hp. and especially at low speeds, the cynchronous motor is more desirable, especially where the high power factor is rewarded.[A2-24]

Bibliography of Recent Water Works Literature

To find an indicated reference, find the given letter and bold-face number at the left of the column, and the light-face number (following the dash) immediately below this. The bold-face number indicates the month of issue of Public Works in which the article was listed, which is generally the current but may be a previous one.

c, Indicates construction article; *n*, note or short article; *p*, paper before a society (complete or absract); *t*, technical article.

D 3 *The Surveyor*
January 17
1. Water Supply and Drainage in the United Provinces (India), p. 83.
2. *p.* The Handling and Use of Liquid Chlorine, p. 91.

January 31
3. Water Supply in the Year 1935, pp. 150-157.

E 3 *Engineering News-Record*
January 30
1. Modified Soil Control Proposed for Rolled-Fill Dam Construction. By F. B. Campbell, pp. 138-139.
2. Water Resources Problems Studied by State Planning Boards, p. 165.

February 6
3. Water Resources Studies. By T. Saville, pp. 220-222.

February 13
4. A New Source of Water Supply for Fort Smith, Ark., pp. 240-244.

F 3 *Water Works Engineering*
February 5
1. Greatest Financial Losses Occur at Low Meter Flows. By A. T. Cook, pp. 120-123.
2. *p.* Effective Dispersion Secured in Copper Sulphate Treatment. By R. F. Goudey, pp. 124-129.
3. Laboratory Control: Tastes and Odors. By C. R. Cox, pp. 132-134.

February 19
4. Soviet Russia Develops Water Supply for an Automobile City. By M. N. Slessarev, pp. 180-182.
5. *p.* Correct Lubrication Pays By W. B. Phillips, pp. 184-186.
6. Selling Water by the Ton. By E. W. Clark, pp. 187-188.
7. *p.* How Plankton Are Controlled at Pasadena. By C. W. Sopp, pp. 189-192.
8. Laboratory Control: Tastes and Odors. By C. R. Cox, pp. 193-195.
9. *p.* Frost Penetration as Affected by Weather and Snow Conditions. By H. U. Fuller, pp. 195-216.

J 3 *American City*
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1. Water Meters Reduce Costs by Stopping Rise in Water Consumption, pp. 58-60.

L 3 *Civil Engineering*
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1. *c.* Safety on the Colorado River Aqueduct. By T. W. Osgood, pp. 102-103.

M 3 *Canadian Engineer*
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1. New Intake Pipe and Pump House at Collingwood, Ont. By W. B. Redfern, pp. 3-5.
2. *p.* The Design and Application of Siphon-Spillways. By C. D. H. Braine, pp. 7-8.
3. Municipal Practice in Water Main Extensions, pp. 10-11.

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4. Laying Reinforced Concrete Pipe at Regina, Sask. By J. W. D. Farrell, pp. 5-11.
5. *p.* Problems of Water Purification Plant Operation. By E. E. Wolfe, pp. 13-14.

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6. New Water Supply System at Aurora, Ont. By D. H. Fleming, pp. 3-4.
7. Laying Reinforced Concrete Pipe Lines at Regina, Sask. By J. W. D. Farrell, pp. 5-8.
8. Financing Water Works Distribution Systems, pp. 10-11.

N 3 *The Earth Mover*
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1. *c.* The World's Largest Dam (Grand Coulee) Progresses, p. 7-11.

P 3 *Public Works*
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1. Novel Control Valve for Elevated Water Tank. By O. J. Semmes, Jr., p. 9.
2. Materials for Construction of Earth Dams. By W. A. Hardenbergh, pp. 17-18.
3. Equipment Used in Water Purification: Handling Chemicals, pp. 20-22.
4. Cost of Laying Water Pipe with Relief Labor, pp. 39-41.

W 3 *Johnsons National Drillers Journal*
January-February
1. Prospecting for Water and Testing Wells pp. 2-6.

Y 3 *Journal, Pennsylvania Water Works Operators Ass'n.*
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1. Fire Protection. By W. C. Hawley, pp. 47-58.
2. Causes of Tastes and Odors and Methods of Correction By N. J. Howard, pp. 59-74.
3. *t.* A Correlation of Differential Tests for the Colon-Aerogenes Group. By R. D. Hoak, pp. 75-93.
4. Typhoid Fever. By C. F. Drake, pp. 94-133.
5. Legal Responsibilities of Water Works Officials for Typhoid Fever. By J. A. Beck, pp. 134-148.
6. Public Relations. By W. L. Eisert, pp. 149-155.
7. Modern Methods of Water Purification. By R. S. Weston, pp. 156-167.
8. Recent Progress in the Art of Water Supply. By T. H. Wiggin, pp. 168-180.

Notes on Use of Activated Carbon in Water Treatment

TARENTUM, Pa., uses 50 pounds per mg. of activated carbon in the water flowing to the filters, employing dry feed. W. G. Ross, secretary.

Sacramento, Calif., C. M. Hoskinson, chief engineer, adds 2 pounds per mg., using solution feed, and applying ahead of pretreatment.

Denver, Colo., C. R. Geisel, supt., prechlorinates and preammoniates, using a ratio of 1:3, and also uses 16 pounds per mg. of activated carbon, applying this in the water flowing to the filters.

Activated carbon, mixed with alum in proportions of 2%, is used at Putnam, Conn. W. C. Butts is operator.

Application of activated carbon to the mixing chamber, at the rate of 7.2. pounds per mg., is the practice at Orlando, Fla. L. B. Fort is general manager of the Orlando Utilities Comm.

At Burlington, Ia., 4 pounds of activated carbon is put into solution with the filter wash water for each filter washed. Frank Lawlor is superintendent.

A dose of 20 pounds per mg. of activated carbon, applied dry to the water flowing to the filters, is used at Ottumwa, Ia. Horace A. Brown is superintendent.

From 5 to 15 pounds per mg. of activated carbon is applied to the mixing chamber by a solution feeder of local design at Independence, Kans. J. C. Gordan, supt.

Topeka, Kans., prechlorinates and preammoniates, the ratio varying from 1:4 to 1:7; a residual of 0.4 ppm reaches the filters, and a residual is carried through the filters. From 2 to 10 pounds per mg. of activated carbon is added to the water flowing to the filters. Daniel H. Rupp is production engineer.

New Orleans, La., adds 6.6 pounds of ammonium sulphate and 6.5 pounds of chlorine per mg., just before filtration. A residual of 0.70 to 0.60 reaches the filters, and 0.60 to 0.50 passes through the filters. No additional chlorine is added. Alf. F. Theard is general superintendent.

At Baltimore, Md., water is prechlorinated and preammoniated, with a residual of 0.1 ppm reaching the filters. A dose of 8 pounds per mg. of activated carbon is added in solution to the mixing chamber. Leon Small is water engineer.

Split feed is used in the Washington Suburban Sanitary District, with 35 pounds per mg. going to the mixing chambers, and 14 pounds per mg. to the filters; dry feed. Harry Hall, acting chief engineer.

Ely, Minn., uses carbon only at "turn-over," but prechlorinates and preammoniates, the ratio being 1:4. Paul Buccowich, Jr., is superintendent.

St. Louis, Mo., John B. Dean, water commissioner, treats water with equal parts $(NH_4)\ SO_4$ and Cl. Practically all of the residual reaches the filter; additional chlorine is added. Activated carbon is used at times, applying about 10 pounds per mg. to the water flowing to the filters, in a solution feed with ammonium sulphate.

Lyons, N. Y., used 30 pounds per mg. of activated carbon, fed dry. Geo. S. Miller, clerk.

Activated carbon is used at times at Troy, N. C., at the rate of 6 pounds per mg., applied with the alum. G. W. Lassiter, supt.

Cincinnati, O., reports post-ammoniation and post-chlorination ratios of 1:2.5 to 1:3.5, with an average residual in town of 0.04 ppm. Activated carbon is used when tastes occur, fed dry, at the rate of 14 to 22 pounds per mg., half to the mixing chamber and half to the filters. A. S. Hibbs, supt.

Columbus, O., uses 15 pounds per mg., applied to the filters by dry feed. C. B. Hoover, supt.

In Fostoria, O., 10 pounds of activated carbon per mg. are applied to the mixing chamber with alum, using a 5% mix. J. William Lord, supt.

Occasional use of activated carbon is reported by Lorain, O., using 46 pounds per mg., fed in solution to the mixing chamber. C. A. Pauly, chief engineer.

Practices in 19 municipalities, including Wilkinsburg, Pa., are reported by W. C. Hawley, chief engineer and general superintendent. Prechlorination permits 0.2 ppm residual to reach the filters. From 8 to 20 pounds per mg. of activated carbon are applied to the water flowing to the filters, using dry feed

The Wakefield Water Co., Narragansett R I., T. G. Hazard, Jr., mgr., uses 30 pounds per mg. of activated carbon, by dry feed, to water flowing to the filters.

During 4 months of the year, Corsicana, Tex., applies 6 pounds per mg. of activated carbon mixed with alum (6%). Wm. V. Mowlam, city engineer.

Wellsburg, W. Va., does not use carbon; the water is chlorinated, and then ammonia added (ratio 1:5) before the water goes to the zeolite softener. Superchlorination is employed to remove manganese. J. F. Thompson, secy.

Racine, Wis., uses activated carbon at times, feeding 12 pounds per mg. in solution to the water flowing to the filters. W. A. Pierce, mgr.

Activated carbon is added (2 to 7 ppm) to the water half way through the coagulation basins at Winston-Salem, N. C. Pre- and post-chlorination are also used. Reported by the late H. L. Shaner, Com'r of Public Works.

In Akron, O., pre- and post-chlorination are used regularly to maintain a residual of 0.1 to 0.2 ppm. During part of the year activated carbon is used, the dose ranging from 5 to 15 pounds per mg., by dry feed to an ejector which discharges through 50 feet of 2-inch hose to the water flowing to the filters. W. R La Due, chief engineer and acting supt.

Nashville, Tenn., maintains an ammonia-chlorine ratio of 1:3 in summer, with a 1.2 ppm residual, and a ratio of 1:4 in winter with a 0.7 residual. When taste occurs, 50 pounds per mg. of activated carbon, applied by dry feed, is fed to the mixing chamber. R. L. Lawrence, Jr., is supt. and chief engineer.

About 2 ppm of activated carbon is applied to water flowing to filters, using dry feed, in Dallas, Tex. J. B. Winder, supt.

Manchester, Conn., feeds activated carbon with alum solution to the filters at the rate of 10 pounds per mg., applying it in a ratio of 5% with the alum. F. H. Parker, supt.

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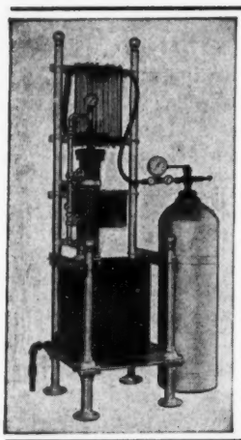

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applied by solution feed to the mixing chamber at Weiser, Idaho. Lyle Wood, city engr.

A dose of 20 pounds per mg. of activated carbon is applied by dry feed machine to the mixing chamber at Bloomington, Ill. Prechlorination and preammoniation are also used, the dosage ratio being 1:1. C. C. Williams, supt.

The Cairo Water Co., Cairo, Ill., uses activated carbon at times, by solution feed, to the filters, at the rate of 3 pounds per mg. C. M. Roos, vice-president.

A 3% mixture of activated carbon and alum is used at Jacksonville, Ill., giving a dose of 8 to 12 pounds per mg. in the mixing chamber. G. F. Stoldt, supt.

Lake Forest, Ill., reports using from 30 to 200 pounds of activated carbon, all applied by dry feed to the mixing chambers. Prechlorination and preammoniation are also used, in the ratio of 3:1. J. C. McNicol, mgr.

Another installment of this article will appear in an early issue.

Standard Colors for Traffic Signals

Colors for traffic signals have been investigated by a committee of the American Standards Association. This committee found that a red light of 75 candlepower, with an average daylight landscape background, could be identified at a distance of 600 feet, whereas a green light had to be of 250 candlepower, a yellow light 750, and a blue light 1,000 candlepower to be identified at the same distance. It was also found that some colors penetrate fog and smoke better than others. Red and orange, for instance, penetrate fog most easily; green becomes invisible most quickly in fog.

Because of the greater general visibility of red and green, and because red was found to be popularly associated in the public mind with the idea of danger, the committee agreed upon the present traffic-light color scheme—Red, Stop; Green, Go; Yellow or Amber, Warning.

The research which led to the decision to make red, green, and yellow the standard colors for traffic lights, also took into consideration the effect of colors on those who are color-blind. Approximately four per cent of the entire population, or nearly 5,000,000 people, it was found, are color-blind to some extent. The greater number of these have difficulty in distinguishing between green and red, but do not have difficulty in distinguishing blue and red. Therefore, the exact shades of red, green, and yellow were specified. In order that most color-blind people can see the change from red to green lights, the green specified in the standard is what is known as admiralty green, and verges very closely on blue.

Oil Field Brines to Lay Dust on Highways

Salt brine obtained from oil wells is used to compact dust on Michigan's county roads at an annual cost of about $100 per mile for the four applications found necessary. At the same time the use of the brine for highway dust-laying solves the problem of salt water disposal in the state's oil fields.

The brine, transported as a liquid and sprayed upon the roads from a truck, contains chlorides of sodium, calcium, and magnesium which attract moisture from the air and from the soil beneath, making an effective dust palliative.

More than 163 miles of gravel road were treated satisfactorily last year.

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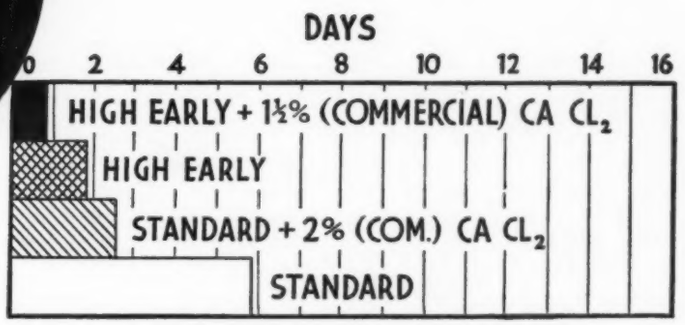
CALCIUM CHLORIDE

increases STRENGTH AND SHORTENS CURING TIME

2500 LBS. "OPENING STRENGTH" IN LESS THAN HALF THE TIME WITH EITHER HIGH EARLY STRENGTH OR STANDARD CEMENTS



TEMPERATURE 70° F

CALCIUM CHLORIDE is a time-tested and proven material for speeding the hardening of cement. It adds desirable qualities to *all* Portland cements.

At all ages and in all temperatures, Calcium Chloride hastens the rate of hardening and produces higher early strength. The chart at the right shows a test in which an "opening strength" of 2500 pounds was obtained, through the use of Calcium Chloride, in less than half the time required for mixes not including Calcium Chloride. Calcium Chloride is particularly valuable as an accelerator for cold weather work, whether for buildings, floors, pavements, bridges, or other concrete structures.

Calcium Chloride is approved by the U. S. Bureau of Public Roads, the U. S. Bureau of Standards and other leading authorities. It has fifteen years of successful performance to its credit.

Write any of the following association members for further information.

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CALCIUM CHLORIDE
FOR MODERN CONCRETE CURING

When you need special information—consult the *classified* READERS' SERVICE DEPT., pages 59-61

One of the trucks of the Massachusetts State Highway Department equipped as described by Mr. Delano.

Accessories for State Highway Motor Trucks

By G. H. Delano

Chief Engineer, Massachusetts Department of Public Works

THE Massachusetts Department of Public Works, after having serious difficulties with the common 6- to 8-volt system used on trucks, decided to experiment with 12- to 16-volt systems with large generators. These systems have been used to some extent for bus equipment but seldom in trucks.

Practically all of the state-owned equipment used by this Department at times works throughout the night removing snow from its main highways. During snowstorms and many other times throughout the winter visibility is poor and surfaces become slippery. These unfavorable driving conditions have caused many serious accidents and damage to the equipment. In order to overcome this there have been many devices added in the form of accessories to minimize the number of accidents. Some of these have been for the comfort and convenience of the drivers. Others have been in the form of warnings to other motorists. As these devices were added, the common 6- to 8-volt systems in use became more and more inadequate.

The Department now includes in its specifications for 1½-ton trucks, such as Fords and Chevrolets, a complete 12- to 16-volt system with a 330-watt generator and on the larger trucks a 12- to 16-volt system with a 550-watt generator. These systems to date have proven very satisfactory and our trucks are much safer on the highways as there are special lights to warn approaching motorists, others to illuminate the equipment, and accessories for the comfort of the driver to increase the care taken in the operation.

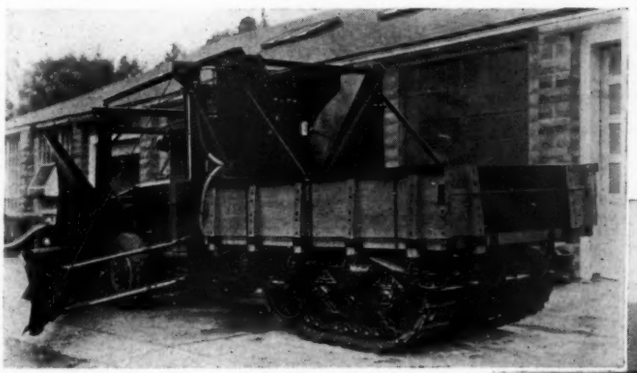
As an example of what is required on our trucks, I am listing below the accessories as called for on requisitions for large trucks to be used on snow removal work:

1. Air brakes on all four wheels.
2. Special generator, motor mounted, capable of developing 600 watts from 1100 r.p.m. to 4000 r.p.m. generator speed.
3. Two heavy duty six- to eight-volt batteries.
4. Electric headlights.
5. Two tail and stop lights, one mounted in the rear of the chassis and one mounted on the rear left upper corner of the cab.
6. Two Casco sleet eaters, one for each side of windshield.
7. A cabinet equipped with clips or other device to hold one complete change of bulbs built into or attached to the inside of the cab.
8. Turn signals of the flasher type operated by a control on the steering post and so placed that the driver can operate them with the right hand, one set on the forward part of the cab roof, one set in rear of frame, and a buzzer sufficiently audible to attract the attention of the driver installed.
9. Two sets of three cluster lights, one set on the visor or front end of the cab mounted so the light beam will be horizontal with the ground and one set on a ¾" pipe bracket on the front end of the dump body wired so as to operate with the dump body in any position.
10. One body light showing green forward and red rear attached to the extreme left of the truck.
11. Two adjustable electric spot lights with lenses 5½ inches in diameter or larger, one on each side of roof installed so that ray of lamp will illuminate plow in front of truck while in use and can be reversed to illuminate the body in rear of truck.
12. Senior Tropicaire hot water heater with adjustable thermostat.
13. Ventilating fan, 12- to 16-volt motor of the Haydee special bus model installed in cab.
14. All wiring for special electrical equipment to be encased in ⅜" or ½" brass greenfield and branched with proper junction boxes.
15. Quickly detachable pipe guard rails to be furnished and erected on each side of the body with lantern hooks on both upper rear corners of the rail.
16. Built-in automatic radiator shutter.
17. Twenty feet of air hose with connections suitable for tire inflation.
18. Two rear vision mirrors, one of the inside type and one of the outside type, mounted on the left side of the cab.
19. One windshield cleaner of the compressed air type consisting of two blades of the Way Cross type to clean 90% of the windshield.
20. Lantern brackets for holding oil lanterns mounted outside on the rear corner of the cab.

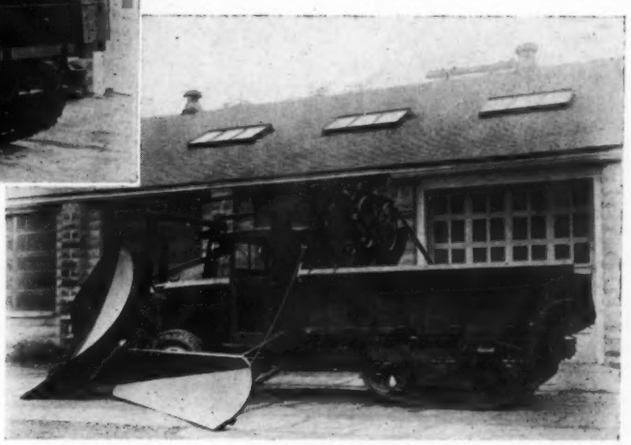
Highways Blocked With Snow!

TRAFFIC SUSPENDED

Food Supplies, Medical Attention and Fire Protection Needed



Linn - Frink Sno - Plow with Full Power Hydraulic Control.



Linn - Frink Sno - Plow with Manual Control.

ALTHOUGH newspapers featured the above headlines across the snow swept nation this winter, the conditions they described did not exist for long in communities which were protected by LINN-FRINK Sno-Plows.

Just as the LINN Tractor surpasses on all types of hauling jobs—it also efficiently handles those unusual snow conditions.

LINN Tractors equipped with LINN-FRINK Sno-Plows keep the highways open in the toughest weather . . . great, powerful machines plow through those huge icy drifts at high speed with amazing ease . . . opening a path wide enough for two cars.

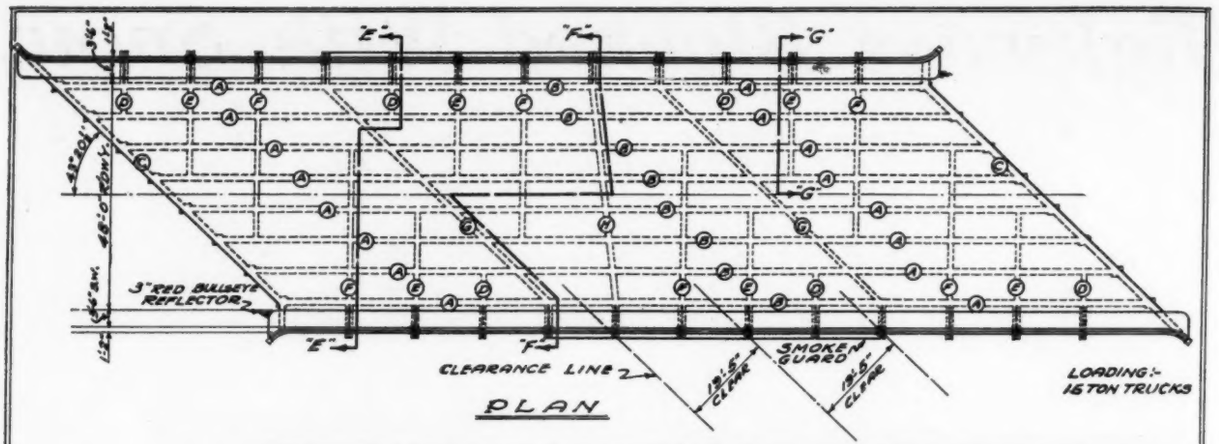
Linn-Frink

SNO-PLOWS

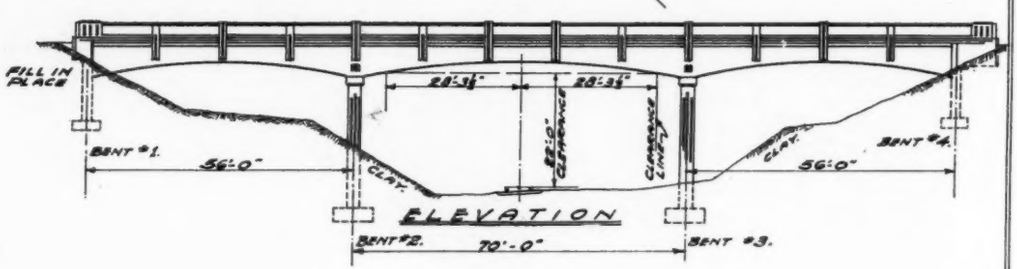
LINN MANUFACTURING CORP., MORRIS, N. Y.

Linn-Frink Sno-Plows are made expressly for the Linn Manufacturing Corp.
By CARL H. FRINK, *Mfr.*, CLAYTON, 1000 ISLANDS, NEW YORK

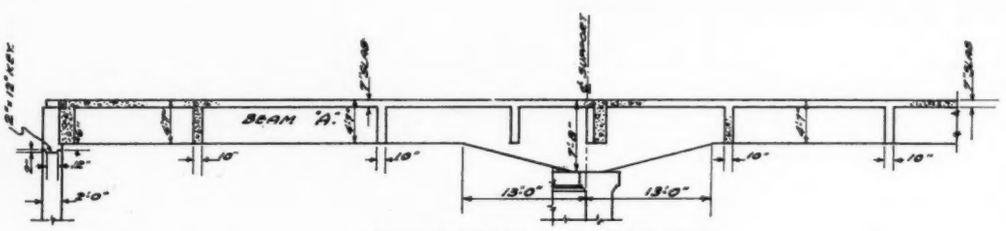
When you need special information—consult the *classified* READERS' SERVICE DEPT., pages 59-61



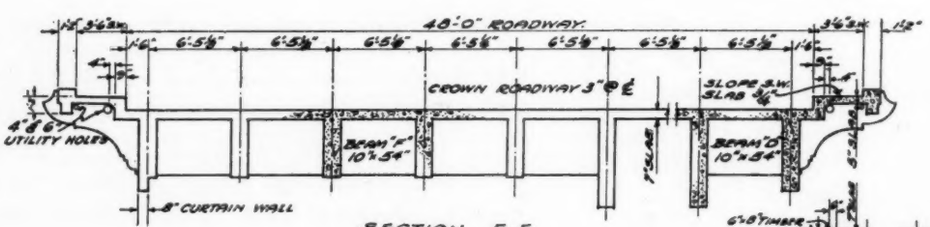
PLAN



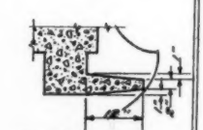
ELEVATION



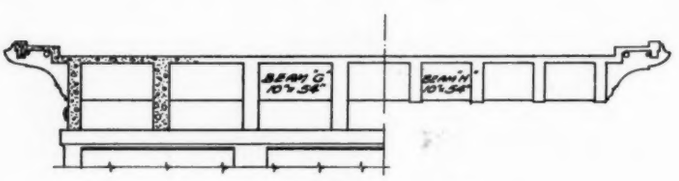
LONGITUDINAL SECTION



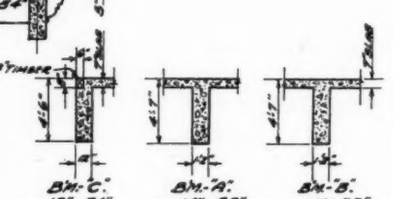
SECTION E-E

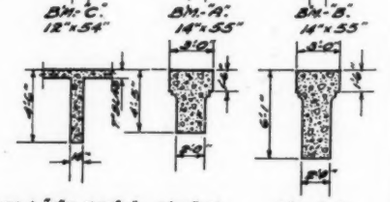


DETAIL OF SMOKE GUARD

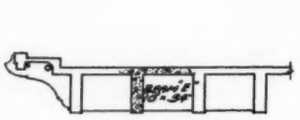


SECTION F-F

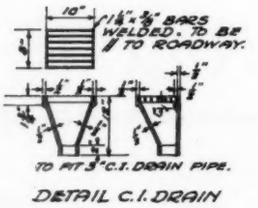




DETAIL OF BEAMS



SECTION G-G



DETAIL C.I. DRAIN

OREGON
STATE HIGHWAY COMMISSION
O.E.R.R. OVERCROSSING
ON
W. SIDE PACIFIC HWY. – MULTNOMAH CO.
PLAN - ELEVATION
AND GENERAL DETAILS
AUG. 30, 1934. SCALE-AS NOTED

An Oregon Grade Crossing Elimination

THE project illustrated on the opposite page is one of the recent projects of the Oregon State Highway Commission. The details of the major items of construction are shown in the drawings. The estimated qualities and costs are:

1,200 c.y.	excavation @ $2.00	$ 2,400.00
100 c.y.	excavation below plans @ $2.00	200.00
750 c.y.	class "A" concrete @ $15.00	11,250.00
240 c.y.	class "D" concrete @ $15.00	3,600.00
191,000 lbs.	metal reinforcement @ 4¼c	8,117.50
390 lin. ft.	concrete handrail @ $3.50	1,365.00
	Sub-total	$26,932.50
	10% E. & C.	2,693.25
	Total	$29,625.75

Cost per lineal foot of bridge, $161.40; per square foot of roadway, $3.36; per square foot, including walks, $2.94.

The overpass was designed for a loading of 15-ton trucks; the concrete was class A, except that above the bottom of the roadway, which was class D, and the handrail. All exposed corners had a ¾-inch bevel. Reinforcing was deformed bars placed 2 inches clear from the nearest face of the concrete. Allowable stresses in class A concrete was 650 pounds per square inch; in class D 800 pounds; and in reinforcing steel 18,000 pounds. The footing elevations shown were variable in accordance with the judgement of the engineer on the job. It was required that supporting beams should not be removed in less than 28 days.

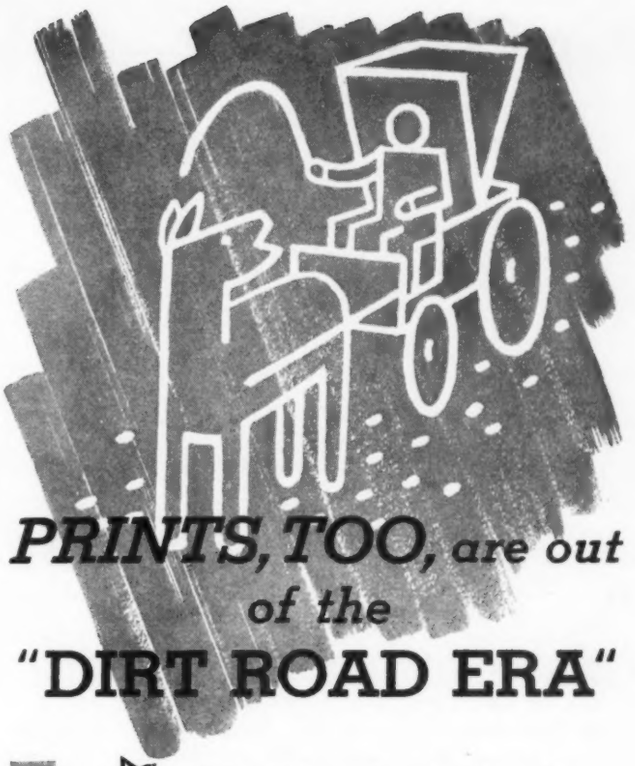
This overpass was designed by the Oregon State Highway Commission, as project NRH 203-B. Cost estimates are as of September 16, 1935. This is one of a number of typical grade crossing eliminations which are illustrated and described very briefly in a recent publication of the U. S. Bureau of Public Roads. Others of these will be shown in forthcoming issues of PUBLIC WORKS.

Aspects of Highway Curve Design

From an advance print, by H. Criswell, Institution of Civil Engineers, (England), in Road Abstracts.

Various forms of curve have been used to make the changes of horizontal direction, such as a plain circular arc; a circular arc compounded with an arc of larger radius near its junction with the tangent; a central circular arc in conjunction with a transition-curve such as the cubic parabola, spiral or lemniscate; or a curve transitional throughout the whole deviation angle. If two circular arcs of different radii are compounded it is necessary to insert a transition-curve with radius progressively increasing or decreasing as the case may be.

Of the three types of transition-curves suitable for road work, the useful limit of the cubic parabola is defined by a deflection-angle of 4°, equal to a deviation-angle of 24° if the curve is transitional throughout; the spiral by a deflection-angle of 9° or deviation-angle of 54° without corrections to deflections, and unlimited if



PRINTS, TOO, are out of the "DIRT ROAD ERA"

Modern highways demand modern plans. That's why so many modern municipal, state and county engineers use BLACK AND WHITE Prints to reproduce their maps and plats. Much easier to read than blue prints—much easier to check—these black-line prints have proved their greater usefulness throughout the country.

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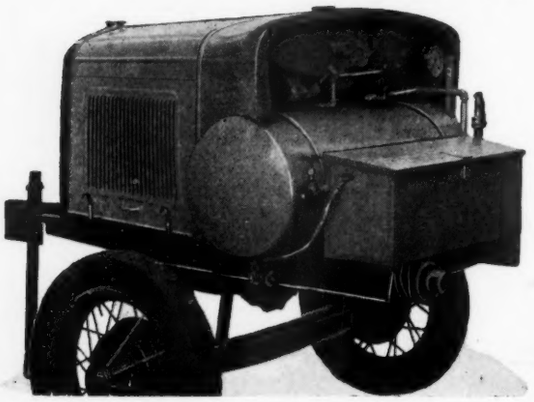

Model A or B Ford Motor fitted with patented Smith Compressor Head with two cylinders for power and two compressing air. Over 60 cubic feet per minute capacity. Head equipped with high speed compressor valves. Automatic unloading and idling. Now used in over forty states to operate jackhammers, paving breakers, clay spades, tampers, riveting hammers, sand blasts, paint sprays, etc.

Low first cost, light weight, economical operation, repair parts available everywhere.

Complete machines available or Smith Compressor Head and accessories with instructions for mounting.

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HAND or WET PROCESS
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HEAVY DUTY
Built for more years of service—sizes for any diameter pipe from 12 to 84 inches—any length—tongue and groove or bell end.
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Makes same sizes pipe as "Heavy Duty" but built to meet demand for lower cost equipment to produce uniform quality in smaller amounts.
Also manufacturers of concrete pipe machines for making pipe by machine process.
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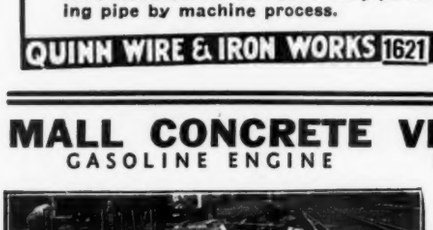
MALL CONCRETE VIBRATORS
GASOLINE ENGINE ELECTRIC



Placing concrete with a 3 h.p. gas engine unit on one of the T.V.A. projects.

A unit for every specific type of concrete structure.

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corrections are applied; and the lemniscate also has no limiting angle in road practice. Although in the case of the spiral a small correction is theoretically required as the deflection-angle approaches 9°, in practice the necessity for such correction is avoided by moving up the instrument on the curve and setting the last few points from the new transit-point.

On an average main route in England the deviation-angle is usually less than 24°, rarely attains 54°, and only in exceptional cases exceeds 54°. It is concluded that the cubic parabola can be applied to the majority of deviation-angles, either alone or in conjunction with a circular arc; the spiral can be applied to all, either alone or in conjunction with a circular arc. The Author considers curve compensation on roads to be an unnecessary refinement. Curves of the compound type found on existing roads, which suddenly sharpen from a large radius to a small one, are dangerous. Also two curves in the same direction joined by a short tangent, should be replaced by a single curve, with a uniform rate of banking, unless a curve transitional throughout is substituted, in which case the rate of banking would increase progressively towards the centre.

Superelevation, Curves and Sight-Lines

Superelevation.—Owing to the great variation in speeds of vehicles, friction-coefficient, weather conditions, and changes in material itself, the results of calculation differ largely. The Author puts forward a table of slopes, based partly on calculation and partly on results of experience. For curves with radii up to 2,864 ft. (2°-curve) slopes varying from 1/12 to 1/40 are recommended. For radii over 2,864 ft. and up to 10,000 ft. a slope equal to the normal camber carried across the whole width of the carriageway is suggested.

Vertical curves and sight-lines.—Changes of vertical alignment should be effected by parabolic vertical curves. On summits the length of vertical curve is determined chiefly by the length of sight-line required, which, in turn, is governed by the speeds and braking distance required by vehicles. A braking efficiency of 50 per cent is assumed, with maximum speeds of 60, 50, 45 and 35 m.p.h. for trunk, class I, class II, and unclassified roads respectively. A margin of safety is allowed by increasing the calculated braking distance required. If a uniform height of eye of 3 ft. 9 in. be taken, and minimum lengths of sight-lines for trunk, class I, class II and unclassified roads be taken at 600, 500, 450 and 300 ft. respectively, the length of the vertical curve will exceed the length of sight-line required when the grade angles, stated as a percentage, are greater than 5, 6.66, 8 and 10.

It is suggesed that where the requisite length of sight-line is not obtainable, the roadway should be widened to provide greater space for the avoidance of collisions. On sags or valley-curves, sight-line requires no special consideration, but the cost will limit the length of vertical curve to be employed. All minor changes of gradient, whether at a summit or sag, should be made by means of vertical curves not less than 200 ft. long where sight-line is not affected, instead of merely rounding off the intersection in the space of a few feet.

Bridge-approaches.—Vertically, bridges and their approaches should be designed as a single unit, to ensure smoothness of passage for vehicles, and less wear and tear on the carriageway. The intersection of gradients at the foot and head of approaches should be rounded off by parabolic curves; the latter could be introduced on many existing bridge-approaches without substantially raising the levels of the roadway.

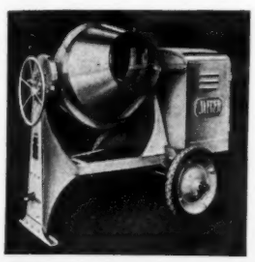
New Tools for the Engineer

Jaeger Concrete Mixers:

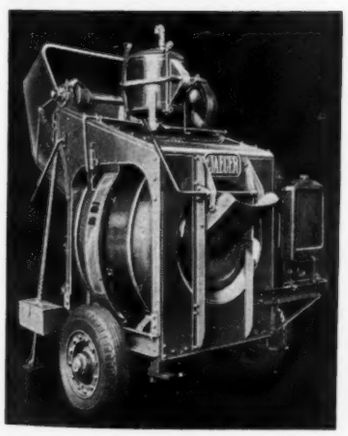
Fastest charging and discharge speeds; smoother operation due to machined steel drum tracks with ball bearing rollers; an average of 25% more engine power; modern designs, and 2-wheel pneumatic tire mounting for 3½S, 7S and 10S mixers, are features announced by The Jaeger Machine Company in its 1936 line of concrete mixers.

For bridge building, curb and gutter and general construction work, the manufacturer stresses the advantages of its 2-wheel 10S and 7S Speed King models. Pneumatic tires permit trailing these mixers behind trucks at speeds up to 35 miles an hour.

Streamlined tilting mixers are offered in 3½S to 7S sizes, a pneumatic tired 3½S trailer, and a popular priced 5S size with 2-wheel trailer mounting and end discharge adapted for work in congested streets, backing up to cellar windows and foundations, and pouring with swinging spout.



Left: Small Tilter; below: Speed King Trailer



Jaeger non-tilting units are being built in 7S to 56S sizes with machined steel drum track standard on all sizes. Skip shaker power loaders and gate-type shaker batch hoppers, with wider, special shape discharge chutes and "forced discharge" bucket action made possible higher speeds and increased production in spite of the dry, sticky mixes used today. To combat abrasive action of harsh concrete and lengthen life of the mixers, Man-Ten steel is used in renewable liners and at points of greatest wear.

A new catalog, giving complete details of this 1936 line, including plaster-mortar and cold patch mixers, concrete buckets and a new type of pneumatic tired concrete buggy, may be obtained by writing to The Jaeger Machine Company, Columbus, Ohio.

6-Wheel Hug Lugger:

The Hug Company, Highland, Illinois, has announced a new 6-wheel Hug "Lugger." In designing this, they have combined the chassis, body and hoist into an integral 12-yard hauling unit, by converting two rear driving axles, ordinarily used under a 6-yard truck, into a front and rear axle drive, and adding a 6-ton trailer axle as a center axle. Sufficient carrying capacity has been built into this track to justify the installation of a Caterpillar Diesel Engine.

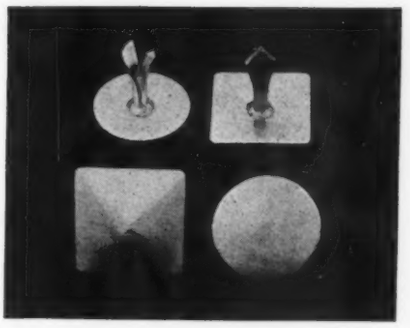
The Hug Lugger

New Ditcher with Diesel Engine:

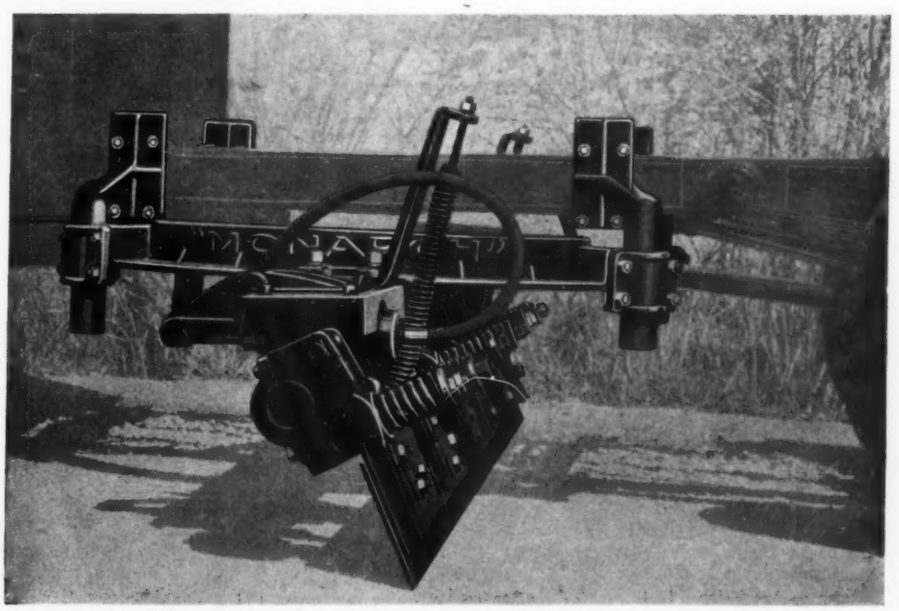
Production of a new Diesel trench excavator is announced by the Parsons Company, manufacturers of a complete line of this type of machinery at Newton, Iowa. This machine is known as Model No. 48. It is equipped with a 102-horsepower, 6-cylinder "Caterpillar" Diesel engine, but is also available with three- or four-cylinder Diesels.

The Diesel excavator is especially adapted to dig sewers and other deep trenches. Standard digging equipment is for 18-foot depth and 48-inch width, but attachments enable it to dig both wider and deeper. The machine is semi-crawler mounted, and the drive sprocket shaft is fitted with a differential gear permitting the outfit to steer readily under working or traveling conditions.

The conveyor is of the reversible type and can load at either side if so required. Twelve digging speeds are provided, through simple sprocket changes. Total weight of Model No. 48 is 60,000 pounds.

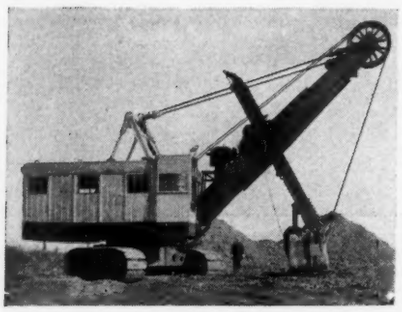


Stainless steel markers, shown above in detail, are shown below on a London, England, street. These markers, which are said to remain bright under all conditions, are a product of the Electro Metallurgical Co., N. Y. Data on request to the Editor

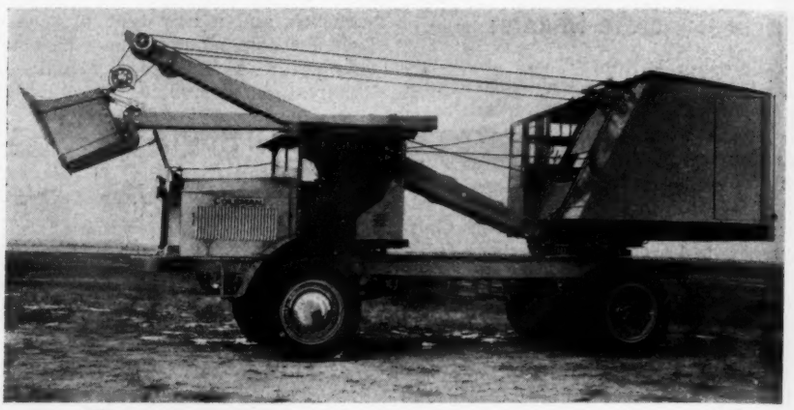


This Scraper is easily attached to any 2½-ton or larger truck; operates at 8 to 15 miles an hour; speeds up road maintenance work and cuts costs. Easily raised out of way when truck is used for other purposes. Manufacturers will send complete and interesting folder on request. Write Monarch Road Machinery Co., Grand Rapids, Mich.

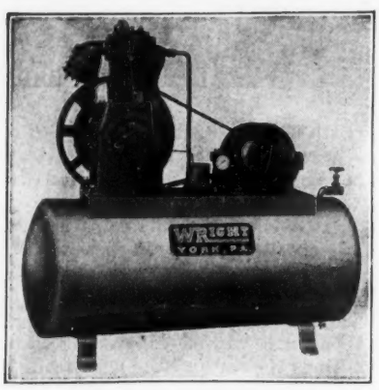
New Equipment in Pictures



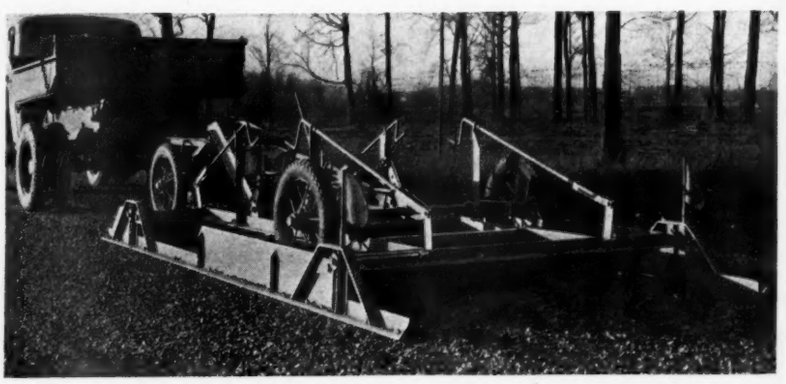
Ward-Leonard electric excavator, built by Harmischfeger, with capacities from 2 up to 4 yards, is said to have complete one-man control, better balance and greater speeds.



This mobile and powerful truck shovel is suitable for a multitude of jobs in any county or city. It can be used as a crane, to drive piles, to unload material and to do all the routine jobs of handling dirt or other material. Easily mounted on any 3- to 5-ton truck. Write for idea book of uses and condensed specifications to Quick-Way Truck Shovel Mfg. Co., Denver, Colo.

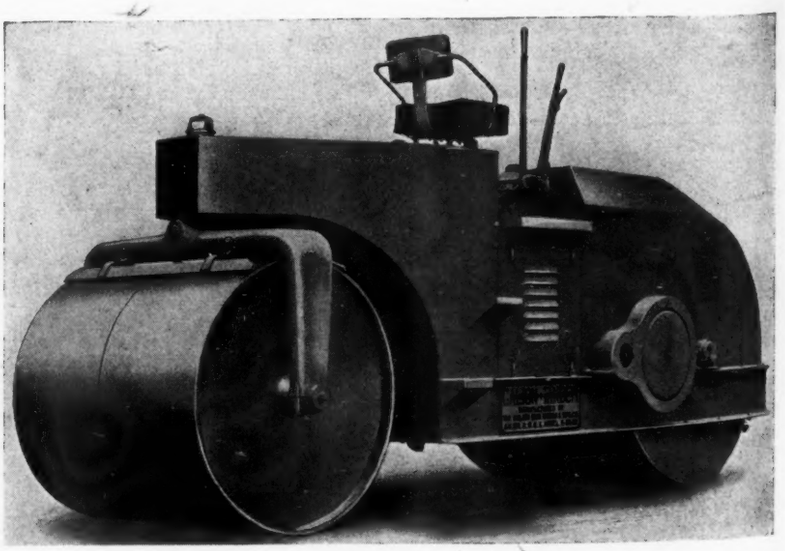


The Wright Air Compressor has particular application in garage and industrial fields. Single and double stage; portable and fixed units, Wright Mfg. Division, American Chain Co., York, Pa.

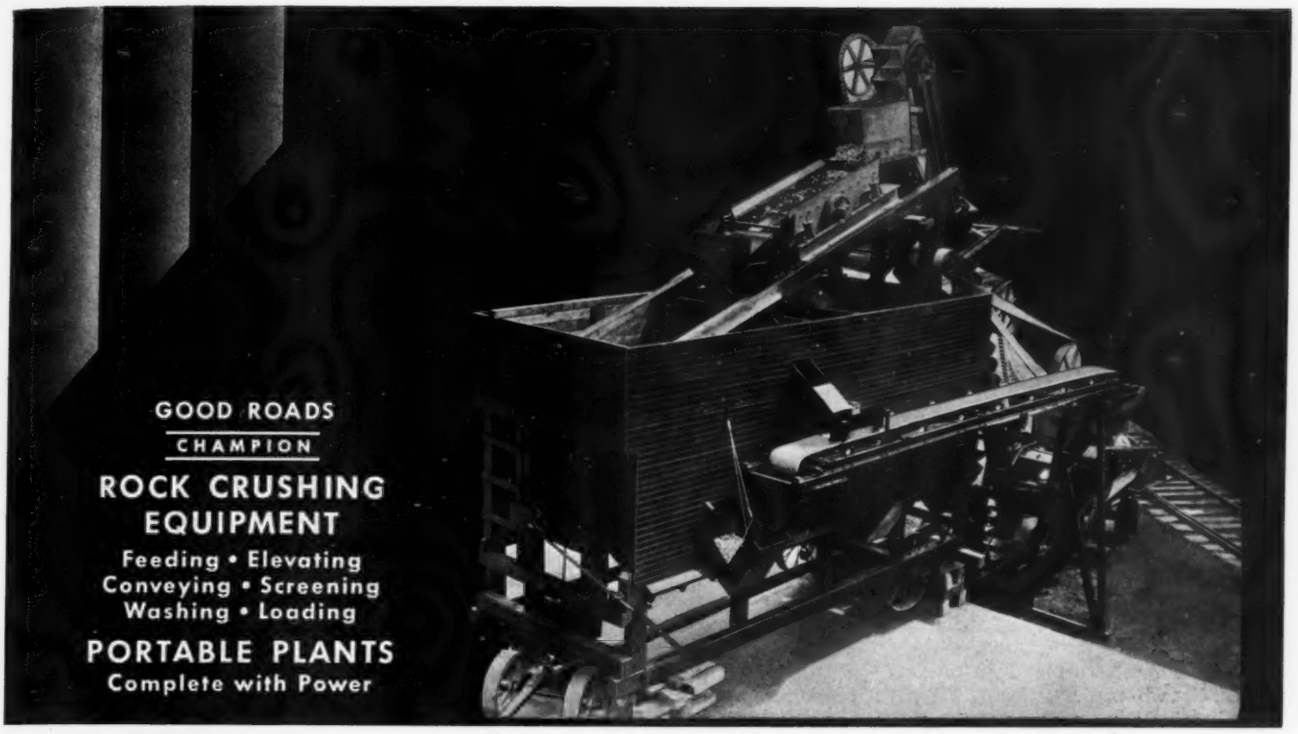


This No. 6 Galion Planer is the lightest and smallest of the Galion line. A 1½-ton truck will haul it. Operating on straight-edge runners 17′ 2″ long, it gives a very smooth surface, and shields maintain a straight, clean edge by preventing spilling over of aggregate.

Lewis Mfg. Co., Decatur, Ill., who make the Street Striper shown above, state that most any city of 20,000 can pay for this striper out of the saving in labor costs in one striping of the streets. Full data on request. This firm also makes a cute hand-pushed Street Sweeper especially for cleaning off the street before striping. Ask for dope.



This Galion roller weighs 7 tons. By putting water in the rolls, the weight can be increased as desired up to 10 tons. It is just as modern as its appearance indicates, and the variable weight feature adds to its value.



Good Roads MACHINERY

Other "Good Roads" Products—SNOW PLOWS—SAND & CINDER SPREADERS—HEATING KETTLES — CHIP SPREADERS — MAINTENANCE GRADERS — ROAD DRAGS

GOOD ROADS MACHINERY CORP.

400 UNION ST., KENNETT SQUARE, PENNA.

Exceptionally heavy traffic on this Columbia, Mo. street, yet not one cent of maintenance cost in 29 years service.

Wherever Records are kept . . .

SOME BRICK PAVEMENT Maintenance Costs

$0.0089 per sq. yd. annually during 44 years service—Columbus, O.

$0.0000 per sq. yd. during 29 years service—Columbia, Mo.

73 blocks maintained 20 years for total cost of $12.75—Russell, Kans.

Buffalo, N. Y.—40 year average of all brick less than $0.01 per square yard annually.

ONE fact about modern pavements is definitely established. And that is—brick has the lowest upkeep costs. By *far* the lowest. Above are actual figures on brick. Only brick pavements can turn in maintenance records like these.

And again, in the U. S. Bureau of Roads, long-time experimental test (Chevy Chase) brick maintenance costs are by far the lowest. The reason for this brick supremacy is that brick resists *weather* damage as well as traffic wear.

Resurfacing many types of worn pavement with brick is a growing practice. On old or new pavements, brick pays for itself in a very short time. For further information address National Paving Brick Association, National Press Building, Washington, D. C.

BRICK COSTS LESS PER YEAR

When you need special information—consult the *classified* READERS' SERVICE DEPT., pages 59-61

Book Reviews

"Qualités De L'eau Et Moyens De Correction":

By Dr. Edouard Imbeaux. Reviewed by Francis F. Longley.

It is not often that we have an opportunity to see a phase of engineering extensively compared from the international point of view. In this recent work we are afforded a broad view not only as our practice goes in the United States, but also in France, England, Germany and various other parts of the world.

Dr. Imbeaux is former Professor Applied Hydrology of the L'Ecole des Ponts et Chaussees, of France, and is a member of the Supreme Council of Public Health of France and of the American Water Works Association.

In his efforts to present, for the benefit of French readers, the best experience in connection with American water supply work, the author has included much information which has long been every-day knowledge to American water works engineers. The interest which American engineers will find in this book is, therefore, chiefly in the extensive compilation of information of similar material from sources outside the United States and not commonly found in our literature. Those interested in problems of water purification and the control of water quality will find this treatise broadly informative.

In that section of the book dealing with the methods of analyzing water, there is opportunity for a comparison of numerous different methods in use in different countries. The author's purpose does not seem to have been to make comparisons, since comparative results of different methods are not given, but in setting forth these numerous methods he has done a useful service to those who wish to make comparative studies of the efficiency of different methods.

In American technical literature, different features of the water supply problem are largely dealt with under separate covers by different authors whose work has led them to specialize in their respective fields. Here, however, we find the Biology phase of the problem dealt with under the same cover with the Chemistry and the Engineering phases of water supply work.

It is interesting to note the large number of filters described by the author for domestic use, indicating a demand, or at least recognizing a need for means at the command of a household for purifying the water they use; a need which has become less and less in the United States and Canada, owing to the public policy which has been pursued of making all municipal water supplies safe to drink.

Under the heading of Correction of Chemical Qualities of the Water by the Removal of Oxygen, the story would have been made more complete by reference to one of the most classical cases on record, namely, the deaeration of the water which is pumped through the famous 350-mile Coolgardie pipe line in Australia.

In pursuing inquiries in this unusual treatise, it is not always easy to put one's finger on the subject matter he wants, through the tables of contents. In view of the author's effort to make this work comprehensive, its usefulness could have been increased if an index had been included.

(Other Book Reviews on Page 62)

Meetings

American Water Works Ass'n:

William W. Hurlbut, water distribution engineer, Los Angeles Water and Power Dept., has been nominated for president of the American Water Works Ass'n. William W. Brush has been renominated as treasurer, a position he has held for many years. The 56th convention of the association will be held at Los Angeles, Calif., June 8-12, 1936.

AWWA section meetings are scheduled as follows:

March 23-25 — Kentucky-Tennessee Section—Lexington. Ky. Secretary, F. C. Dugan, State Board of Health, 532 W. Main St. Louisville, Ky.

March 26-27—New York Section—Oswego, N. Y. Secretary, R. K. Blanchard, Neptune Meter Co., 50 W. 50th St., New York, N. Y.

April 1-3 — Canadian Section—Hotel Royal Connaught, Hamilton, Ont. Secretary, A. E. Berry, Ontario Dept. of Health, Parliament Bldgs. Toronto, Ont., Canada.

April 7-9—Southeastern Section — Hotel De Soto, Savannah, Ga. Secretary, W. H. Weir, State Board of Health, 135 State Capitol Bldg., Atlanta Ga.

April 7-9—Indiana Section—Purdue University, Lafayette, Ind. Secretary, J. A. Bruhn, Box 855, Indianapolis, Ind.

April 9-10 — Illinois Section — Evanston, Ill. Secretary, W. D. Gerber, 811 W. Oregon St., Urbana, Ill.

April 17-18—Montana Section—Butte, Mont. Secretary, H. B. Foote, State Board of Health, Helena, Mont.

May 14-16—Pacific Northwest Section—Aberdeen, Wash. Secretary, E. C. Willard, 720 Corbett Bldg., Portland, Ore.

AWWA—Southeastern Section:

The Southeastern Section of the American Water Works Association will hold its annual meeting in Savannah, Georgia, April 7-8-9, 1936. The DeSoto Hotel will be the convention headquarters. W. H. Weir, 135 State Capitol, Atlanta, Ga., is secretary.

Maryland-Delaware Water And Sewerage Ass'n:

The tenth annual conference of this association will meet at the Francis Scott Key Hotel, Frederick, Md., May 14-15. A. W. Blohm, 2411 No. Charles St., Baltimore, Md., is secretary.

Public Health Engineers:

The U. S. Civil Service Commission is receiving applications up to March 16 for associate and assistant public health Engineers for the U. S. Public Health Service. Age limits 45 and 40 respectively. Pay $3,200 and $2,600. On the examination, education and experience counts 70, and publications, thesis, etc., 30. Rating will be obtained from applications. You can get data from the U. S. Civil Service Commission, Washington, D. C., or perhaps at your post office.

Personal Items

Glenn D. Holmes, Syracuse, N. Y., has been retained by the Onondaga County Sanitary Sewer and Public Works Commission as Director-Chief Engineer for the construction of 5½ miles 36-inch to 48-inch sewers, plans for which are completed. Detail drawings for a 4½ million gallon sewage treatment plant are in course of preparation under an approved WPA project.

J. F. Laboon, formerly with Chester, Campbell, Davis and Bankson, consulting engineers of Pittsburgh, has been appointed highway engineer of Allegheny County, Pa.

Norman Hebden, who has been with the Bureau of Public Roads, has become assistant director of the joint staff of the American Society of Municipal Engineers and International Association of Public Works Officials.

J. D. Webb, city engineer of Birmingham, Ala.; A. Clinton Decker, sanitary engineer of the Tennessee Coal, Iron & R. R. Co. and O. G. Thurlow, formerly chief enginer of the Alabama Power Co., have been appointed as the engineering commission for the new Birmingham Industrial Water Supply, a $6,000,000 project recently approved by the PWA. A. C. Polk, formerly of the Dixie Construction Co., has been appointed executive engineer.

Robert B. Morse, chief engineer of the Washington Suburban Sanitary District, Hyattsville, Md., died Jan. 31, after an illness of about three weeks. Mr. Morse was 56 years old, and had served in engineering work, principally in Maryland, for 32 years. He was chief engineer of the Maryland State Department of Health from 1912 to 1922, and since 1918 had been chief engineer of the Washington Suburban Sanitary District.

Timewasters

[*Continued from page 7*]

Five men were beginning a poker game, their names were Brown, Perkins, Turner, Jones, and Reilly. (Not respectively)

They smoked Luckies, Camels, Kool, Old Golds, and Chesterfields. (Not respectively)

At the beginning of the game, the number of cigarettes possessed by each of the players was 20, 15, 8, 6, and 3. (Not respectively)

1. Perkins asked for three cards.
2. Reilly had smoked half his original supply, or one less than Turner smoked.
3. The Chesterfield man originally had as many more, plus one-half as many more, plus 2½ more cigarettes than he now has.
4. The man who draws to an inside straight, absentmindedly lit the tipped end of his fifth cigarette, the last he smoked.
5. The man who smokes Luckies has smoked two more than anyone else, including Perkins.
6. Brown drew as many aces as he originally had cigarettes.
7. No one has smoked all his cigarettes.
8. The Camel man asks Jones to pass Brown's matches.

Now, how many cigarettes did each man have to begin with, and what brand. (All cigarettes were wholly smoked.)

Contributed by Ray A. Giddings

Readers' Service Department

CONTINUED FROM PAGE 60

These booklets are FREE to readers of PUBLIC WORKS.

pression Coupling, Style 65, which is compact and self contained, makes a permanently tight joint under all conditions and is installed on plain end pipe in a few seconds with only one tool, a wrench. Get your copy today. S. R. Dresser Mfg. Co., Bradford, Pa.

Pipe Joint Compound

411. A new bulletin has recently been issued giving full details concerning Tegul Mineralead, a quick-sealing, trouble-free compound for bell and spigot joints which permits immediate closing of the trenches. Write The Atlas Mineral Products Co. of Pa., Mertztown, Pa.

Taste and Odor Control

412. How, when and where activated carbon can and should be used to remove all kinds of tastes and odors from water supplies is told in a new booklet just issued by Industrial Chemical Sales Co., Inc., 230 Park Ave., New York, N. Y. 32 pages, table, illustrations and usable data.

Pumping Engines

413. "When Power Is Down," gives recommendations of models for standby services for all power requirements. Sterling Engine Company, Buffalo, N. Y.

Rubber Lined Tanks for Chemicals

414. Details of construction of Ace acid-proof, rubber lined, steel tanks for use in mixing and storing chemicals used in treating sewage and water are given in a new catalog issued by American Hard Rubber Co., 11 Mercer St., New York, N. Y. Covers all sizes up to 20,000 gals.

Rubber Lined Pipes and Pumps

415. New, 68-page catalog describes Ace rubber lined pipe and fittings, hard or soft rubber lined centrifugal pumps and Ace hard rubber double acting pumps, for chemicals used in treating sewage and water and for acids and other corrosive liquids. Contains illustrations and specifications. Issued by American Hard Rubber Co., 11 Mercer St., New York, N. Y.

Runoff & Stream-Flow

416. Technical information on measuring run-off, both from smaH areas, for storm sewer design, and from large areas for determining water-shed yield, and instruments for measuring. Julien P. Friez & Sons, Baltimore, Md.

Screens, Sewage

418. Sewage screens (Tark, Brunotte, and Straightline) for fine and coarse sewage; Straightline Collectors for Settling Tanks (Sludge, Scum and Grit), and Mechanical Aerators for activated sludge plants. Link-Belt Company, 307 No. Michigan Ave., Chicago, Ill. Book 642.

Rainfall Measurement

419. The measurement of precipitation, exposure of gauges, description of apparatus for measuring rainfall, both rates and amounts. Bulletin RG and Instruction Booklet. Julien P. Friez & Sons, Baltimore, Md.

Screens

420. Water Screen Book No. 1252, describes water screens and gives complete technical information about them. Link-Belt Co., 307 No. Michigan Ave., Chicago, Ill.

Sludge Bed Glass Covers

422. Sludge Bed Glass Covers—"Super-Frame." Hitchings & Co., Elizabeth, N. J. Offer A. I. A. File 101SB, describing glass covers for sludge and sprinkler beds; details, specifications and cost data.

Sludge Drying

424. Relatively dry cake sludge in demand for fertilizer is produced by automatic continuous vacuum filters like those used in Milwaukee, Houston, Chicago, Gastonia, N. C., Charlotte, N. C. Write for literature. Oliver United Filters, Inc., 33 West 42nd St., New York, N. Y.

Sludge Incineration

427. A multiple hearth furnace which meets the most exacting municipal sanitary requirements for the incineration of sewage sludge—produces a fine ash or partially dry sludge for fertilizer—is described and illustrated with drawings and photographs in bulletins issued by Nichols Engineering and Research Corp., 40 Wall St., New York, N. Y. Operation as well as installation data is given.

428. Disposal of Municipal Refuse: Planning a disposal system; specifications. The production of refuse, weights, volume, characteristics. Fuel requirements for incineration. Suggestions for plant inspection, 45 pp., ill. Also detailed outline of factors involved in preparation of plans and specifications. Morse-Boulger Destructor Co., 202P East 44th St., N. Y.

Sludge Removal Equipment

429. If you are interested in economical sludge removal, write for the latest bulletin describing and illustrating Louden Monorail equipment which is adapted to open or closed beds. Full details sent promptly by the Louden Machinery Co., 400 West Ave., Fairfield, Iowa.

Swimming Pool Equipment

430. Filters, chlorination, underwater lights and other supplies for swimming pools are very thoroughly described in literature and folders. Plans and layouts. Everson Filter Co., 625 W. Lake St., Chicago, Ill.

431. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data, prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

Treatment

432. New 31-page catalog covers complete conveying, screening and reduction machinery for water purification and sewage treatment; describes and illustrates the design features of Jeffrey self-cleaning bar screen, combined screen and grinder, sewage screenings grinder, grit washer, conveyor type and positive discharge sludge collectors and green garbage grinder—includes installation views. Catalog 615, Jeffrey Manufacturing Co., Columbus, Ohio.

433. Installation views and considerable engineering data including capacity tables for settling tanks and layouts of typical arrangements for both final and primary tanks, are contained in a new booklet—No. 1542—just published for engineers by Link-Belt Company, 307 No. Michigan Ave., Chicago, Ill.

436. Standard Sewage Siphons for small disposal plants and PFT Rotary Distributors are new catalogs recently issued by Pacific Flush Tank Co., 4241 Ravenswood Ave., Chicago, Ill. The latter catalog contains typical plans and many illustrations of actual installations.

438. Eliminate sludge bed troubles, forget about weather conditions, odor nuisance, hail insurance and the like. Full details as to how Oliver United Vacuum Filters overcome these problems will be sent to all interested by Oliver United Filters, Inc., 33 West 42nd St., New York, N. Y.

441. Collectors and concentrators for modern sewage treatment plants, recent installations, and full data on aerators, and screens. Link-Belt Co., 307 No. Michigan Ave., Chicago, Ill., and Philadelphia.

442. Full information regarding their newest equipment for sewage treatment and water purification will be sent on request by The Dorr Co., 247 Park Ave., New York, N. Y.

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For the Engineer's Library

The editors will be glad to assist readers in getting copies of publications mentioned here.

Floods in the United States:

This is Geological Survey water-supply paper No. 771, and it's some paper, 497 pages. In the first 90 pages are described the more common methods of estimating floods—using flood frequency formulas, probability methods and methods dependent on relation of rainfall to runoff. There are 23 pages of momentary flood peaks in a large number of rivers; following this are 282 pages of records of floods on selected rivers. There are 22 illustrations. Looks like it ought to be in the hands of everyone interested in flood flows. For sale by Superintendent of Documents, Washington, D. C., $1 with paper cover.

Rainfall and Runoff Relations:

This is Geological Survey Water Supply paper 772, 301 pp.; 89 ills.; 66 tables. A very fine text covering precipitation factors and changes, temperatures, stream flow, surface runoff, etc. For sale by Superintendent of Documents, Washington, D. C., 25 cents with paper cover.

Handbook on Painting:

Vest pocket size, 125 pp. Covers painting of exterior wood, stucco, concrete, brick, stone, interior wood and walls, colored paints, decorative wall finishes, metal, small boats, etc.; considers common painting defects. Gives painting contract form. Write National Lead Co., 111 Broadway, N. Y., for free copy. Right good.

Structural Metal Painting:

Vest pocket size, 160 pp. Thirteen chapters cover most of the commonly neded data on painting metal structures. Chapters of particular interest include testing paints, estimating areas and costs, preparing the surface, application, and formulas. If you have a bridge, standpipe, tank, yacht or underground pipe to paint, this gives you the dope. National Lead Co., 111 Broadway, N. Y. No charge.

Preservative Treatment Of Wood by Pressure

J. D. MacLean. Madison, Wis., U. S. Department of Agriculture, Forest Service, Forest Products Laboratory. 1935, 123 pp. $0.15.

This pamphlet, which is Dept. of Agriculture Miscellaneous Publication Number 224, is based on the results of extensive research at the Forest Products Laboratory and on numerous experiments and observations made at commercial treating plants. The author has outlined the characteristics of both woods and preservatives as they affect treatment and he has set down in usable form the mathematical material needed in control of treating conditions. The fifty charts and tables especially commend themselves for the readiness with which they yield their information.

Flumes and Flume Hydraulics:

A 50-page booklet containing about all the data on this subject that one could wish for has been published by R. Hardesty Mfg. Co., Denver, Colo. This company uses Armco iron for flumes and the detail description of these flumes, joints, construction details, etc., occupy the first 12 pages. Information on "Capacity of Open Conduits" covers 10 pages and provide most complete hydraulic tables on flow in flumes, freeboard allowance, critical velocities, etc. Other sections cover curves, wood and steel substructures, crossbars, expansion joints, concrete footings, intake and outlet structures and maintenance. No price mentioned; we think if you wrote the above company on your letterhead, you might get a copy without trouble. It's worth trying.

Save Light by Painting:

Prepared with the cooperation of the Better Vision Institute and Better Light-Better Sight Council, the new Sherwin-Williams Save-Lite Catalog is a factual presentation of painting as a part of lighting and "plant conditioning." In a concise manner it tells what a wall and ceiling paint should be, for more economical production, and for beauty and protection.

Other features are the inclusion of illustrated laboratory studies and various industrial applications—including before and after Sight-Meter readings. Case histories, simple charts on lighting standards and plant interior paint uses and applications constitute reference information of interest and value to all plant operators.

Write Sherwin - Williams Company, Dept. IMW-10, Cleveland, Ohio, for free copy.

Stabilized Roads:

Here is a pretty complete and valuable booklet on stabilized roads. It concentrates on plant-mix stabilization, the newest and most promising development in this line. 24 pages; well illustrated, with a lot of detail information. Write Pioneer Gravel Equipment Co., Minneapolis, Minn., for copy. No charge.

Concrete Pipe Construction:

A new catalog and information booklet has been sent us by Quinn Wire & Iron Works, Boone, Iowa. This not only describes Quinn forms, but also tells how to estimate in detail costs of construction and gives detail dimensions and weights. Lots of good dope. Sent on request.

Commstones, Growlers And Undercutters:

These are a few of the many items described in the catalog of Martindale Electric Co., 1378 Hird Ave., Cleveland, O. A commstone is a stone for cleaning commutators; a growler is used to reproduce in wound armatures, rotors or stators while not assembled, the approximate magnetic conditions under which they would operate when completely assembled. This catalog, which contains 40 pages, is a real mine for the crank or the man interested in electrical appliances. Sent on request.

Expansion Bolts:

"Architectural and Engineering Data on Expansion Bolts and Devices for Holding to Masonry" has been issued by The Rawlplug Company, Inc., General Offices and Plant, 98 Lafayette St., New York City. It is loose leaf, of size and punched to fit the leading engineering and architectural binders now in common use, and contains charts, tables, data, specifications, etc. One page is devoted to the showing of the various materials in which anchors are used and the proper type anchors for each. Copy free on request.

American Sewerage Practice:

Vol. III, Disposal of Sewage. By Leonard Metcalf and Harrison P. Eddy; revised by Harrison P. Eddy. Third edition. 836 pages; 227 illustrations; 156 tables. $7.

It is entirely impossible to review a book such as this, and do it at all adequately within the limits of space available. The first 17 pages deal with the development of sewage treatment; the next 12 are given over to a discussion of reasons for treatment. There follow 39 pages on characteristics and behavior of sewage, 20 on elements of sewage analyses, 32 on the composition of sewage; 37 outlining methods of treatment; and 32 on pollution and self-purification of waters. Consideration of treatment methods begin with 43 pages devoted to dilution; 19 to irrigation; 31 to racks and screens; 26 to grit chambers, skimming tanks and storm water tanks; 34 to plain sedimentation; and 12 to chemical precipitation. To sludge digestion, 21 pages are devoted; to septic tanks, 10; to Imhoff tanks 33; to separate sludge digestion tanks 21.

Secondary treatment begins with intermittent sand filters, to which 19 pages are devoted, and continues through contact beds with 11 pages, contact aerators 10, and trickling filters 68. Theory and operation of activated sludge treatment and the design of plants of this type is treated in 106 pages. Utilization and treatment of sludge, drying, dewatering, etc., covers 95 pages; chlorination and disinfection 20 pages; residential and institutional plants 27 pages; industrial waste treatment 22 pages; and operation and maintenance 6 pages.

A bibliography follows each chapter. These references, in general, are for articles and publications through 1934, but some 1935 references are included.